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Diskussionsbeitrag Nr. B-44-20

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Daniela Kühne

This study introduces and tests the applicability of a signal for individual tax reporting aggressiveness using German income tax return data. Tax aggressiveness is often defined as dealing with uncertainty – or more precisely: ambiguity – in an exploitative manner. In other words, firms and individuals are considered tax aggressive if they interpret ambiguous regulations in their favor. It is empirically assessed whether the way individual taxpayers deal with ambiguity in the tax system may serve as a valid indicator for more or less aggressive reporting behavior using a specificity in the German income tax system leading to uncertainty about taxable income. The decision whether to exploit ambiguity or not is attributed to differences in an intrinsic motivation to comply. It is investigated whether and to what extent taxpayers interpreting ambiguity in their favor arrive at a lower tax burden. The results show that taxpayers exploiting ambiguity in the investigated field arrive at a significantly lower effective tax rate than comparable taxpayers not exploiting ambiguity. It is concluded that the former incur lower psychic costs when using tax positions with uncertain consequences and that exploiting ambiguity can serve as an indicator for more aggressive reporting behavior. More aggressive reporting behavior is analyzed as a dependent variable to study the factors shaping it.

Keywords: tax aggressiveness, nonbusiness tax

JEL classification: H24, H26, D91

1 Introduction

The notion of tax aggressiveness is mostly associated with multinational firms reducing their tax burden by making use of sophisticated tax planning schemes, exploiting loopholes in national tax law and taking advantage of lack of harmonization between different tax regimes. Tax compliance research is mainly concerned with forms, determinants and consequences of corporate tax avoidance. In contrast, little is empirically known about aggressive reporting behavior of individuals not earning business income but income from employment. Specifically, there are few opportunities to make a pre-audit distinction between more and less aggressive individual taxpayers. Valid indicators are particularly useful to investigate individual factors influencing reporting aggressiveness and to develop and enhance rules for strategic audits.

In Germany, wage earners are subject to major third-party reporting and tax collection through withholding. Still, a wide variety of tax benefits and deduction possibilities leave room for differences in reporting behavior. This study takes advantage of the fact that taxpayers self-assess in the area of income-related deductions by introducing and testing the usefulness of a binary indicator for tax aggressiveness based on taxpayers' reporting behavior concerning two line items of the tax return, namely "working tools" and "other income-related deductions" and an associated specificity of the German income tax system often referred to as *Nichtaufgriffsgrenze*. The notion refers to an amount widely known in Germany as a potentially deductible lump sum for working tools. But it also constitutes an ambiguity in the German income tax system leading to uncertainty about taxable income, as the lump sum is neither legally codified nor can taxpayers be sure about how fiscal authorities will react to them claiming the amount.

Two types of taxpayers are identified based on their reaction to this specific detail of the tax system in order to address the research question of whether the way taxpayers deal with ambiguity is indicative of their general reporting behavior, and thus whether the definition of tax aggressiveness as taking advantage of ambiguity is useful to distinguish between more and less aggressive taxpayers in a real-world

context. Taxpayers in the treatment group are characterized by their willingness to not only make use of officially accepted deduction possibilities but to also claim a lump sum – referred to as the *ambiguous deduction* – the deductibility of which is not explicitly regulated by law, but becomes known to taxpayers through hearsay and is thus uncertain.

In order to test whether differences in taxpayers' reaction to ambiguity can serve as a signal for more or less aggressive reporting behavior, taxpayers' outcome in the form of their effective tax rate is assessed depending on group membership. Propensity score matching is used to ensure the comparability of the treatment and control group. The results indicate that taxpayers using the ambiguous item arrive at a significantly lower ETR than taxpayers not using it, suggesting that taxpayers choosing the confrontational approach when dealing with this specific form of ambiguity also use other ambiguous options to lower their tax burden and may thus – in an outcome-oriented sense – be considered more tax aggressive.

An alternative explanation for the observed results is that taxpayers not making use of the *ambiguous deduction* are just not aware of this option. It is therefore – in a second step – controlled for taxpayers' informedness concerning tax avoidance options in order to ensure that the observed taxpayers make a conscious decision whether or not to claim the *ambiguous deduction*. The results of this refined analysis suggest that taxpayers using ambiguity in their favor arrive at a significantly lower ETR than taxpayers classified as informed about the ambiguous item but deciding not to use it. By contrast, no significant difference can be found between the ETR of taxpayers classified as informed and the ETR of taxpayers classified as uninformed. It is concluded that taxpayers' reaction to ambiguity in a specific case may serve as an indicator for their overall more or less aggressive reporting behavior.

To be able to develop strategies to enhance compliance and to increase the efficiency of audits, it is important to understand the factors influencing the reporting behavior of individual taxpayers. It is thus, finally, investigated whether tax aggressiveness (in the sense of exploiting ambiguity) is associated with observable individual and environmental characteristics, i.e., whether structural differences between

taxpayers lead to differing behavior potentially privileging or penalizing certain groups of taxpayers. Specifically, it is tested whether demographic and socio-economic factors such as gender, age, or income level affect aggressive reporting behavior in the way suggested by compliance literature. Furthermore, it is assessed whether professional tax consultants encourage or discourage the use of ambiguous items.

The empirical investigation is based on a stratified random sample of tax return data of the year 2005, taken from the *German Wage and Income Tax Statistics*. The fiscal year 2005 is used in order to analyze the influence of the existence of a professional tax consultant on the propensity to exploit ambiguity. As a robustness check, the same analysis is performed for the years 2006–2010. The remainder of this article is organized as follows. Section 2 gives an overview of the institutional background concerning the investigated case of ambiguity in the tax system leading to uncertainty about taxable income. Section 3 provides a definition for tax aggressiveness, discusses its relation to ambiguity and derives the hypotheses. Section 4 describes the data set and necessary changes leading to the sample used for the analysis. Sections 5.1–5.3 present the empirical results concerning the influence of exploiting ambiguity on the tax burden. Section 5.4 analyzes factors shaping the propensity for more aggressive reporting behavior. Section 6 concludes.

2 Institutional Background

The German income tax system allows the unlimited deduction of expenses related to the corresponding income-generating activity, i.e., wage-earning taxpayers are allowed to deduct several different expenses, the most important being the commuter allowance (costs for travelling between home and work place), the double household allowance (costs of running two households necessary for employment), and daily subsistence allowances when travelling for work. Likewise, taxpayers are permitted to deduct expenditure for working materials (such as specialized literature, laptops, and office supplies), or bank account fees. Besides the possibility of unlimited deduction of income-related expenses, the German Income Tax Code provides a standard

deduction in the amount of EUR 1,000 per year (EUR 920 for years prior to 2011) covering all of the aforementioned types of deductions. Taxable income of employees claiming expenses less than EUR 1,000, or no expenses at all, is automatically reduced by this amount. Costs not exceeding the standard deduction thus do not have to be proved or itemized. Only if taxpayers intend to deduct a higher sum of income-related deductions are they obligated to itemize and confirm all expenses through submission of receipts or other supporting documents. As a result, taxpayers can choose between the standard deduction and declaration of their higher income-related costs actually incurred.

In addition to the standard deduction and the option to itemize and prove higher income-related deductions, there is a widespread belief amongst taxpayers that – in the context of itemizing – tax authorities waive the submission of proof for certain types of deductions of a specific amount, i.e., a lump sum referred to as *Nichtaufgriffsgrenze*. Concerning the existence and magnitude of such a lump sum, the prevailing opinion amongst taxpayers suggests that tax authorities allow the deduction of an amount of around EUR 110 for working materials without any further specification or proof. The amount goes back to a lump sum of DM 200 (corresponding to EUR 102.26) formerly allowed for working materials, which was repealed in 1998 (OFD Chemnitz, 2003). With that former provision, tax authorities intended to accept small amounts of deductions without itemization for reasons of expediency and to simplify administrative procedures for both themselves and the taxpayers.

But since the provision was abolished, taxpayers do not have a legal entitlement to the deduction of the lump sum (see decision of the Hamburg Financial Court, 22 January 2003 – I 72/02), and administrative practice has tended to be unclear. The Regional Tax Office (*OFD*) of one of the 16 federal states of Germany (Baden-Wuerttemberg, i.e. one of the old West German states) still allowed the deduction of an amount of EUR 110, while the Office of another state (Saxony, i.e. one of the newlyformed German states) indicated that the deduction is inadmissible unless the costs can be proven (OFD Karlsruhe, 2003; OFD Chemnitz, 2003). No information is available concerning the position of the other 14 states. Despite the lack of a legal provision or consistent

administrative opinion, available tax preparation software, practical guidelines, working aids and unofficial instructions on how to file a tax return issued by private operators still encourage taxpayers to enter this amount in their tax returns even today (see, e.g., Konz, 2004; Christoffel & Geiß, 2009; Lexware, 2018). Most working aids refer to a value of EUR 110, but values of EUR 102, EUR 103 or EUR 100 are mentioned as well, obviously stemming from the formerly existing lump sum of DM 200. Given the prevailing uncertainty concerning this deduction possibility, it is, in the following, referred to as the *ambiguous deduction*.

In order to be able to make a distinction between informed and uninformed taxpayers in Section 5.2, a second annual lump sum is introduced: It refers to a value of EUR 16 of deductible expenses for account management fees (see decision of the Brandenburg Financial Court, 9 April 2003 – 2 K 2045/02). Taxpayers can deduct this amount (the value of EUR 15 is mentioned as well in several unofficial sources) irrespective of whether the costs were actually incurred for professional purposes. While neither is explicitly mentioned by law, the main difference between this lump sum and the *ambiguous deduction* is that the former is communicated by fiscal authorities in their official working aid on how to file a tax return.[1] The lump sum is thus referred to as the *unambiguous deduction* and considered equal to all other unambiguously legal deduction options that taxpayers are entitled to. If entered in the tax return in the context of itemizing, both the *ambiguous* and the *unambiguous deduction* have a tax-reducing effect equivalent to legally codified allowances.

[1] https://www.formulare-bfinv.de/ffw/form/display.do?%24context=104DC7A1413264E98F31.

3 Individual Tax Reporting Behavior and its Determinants

3.1 Ambiguity and Tax Reporting Behavior: A Notion of Aggressiveness

Concerning their reporting behavior, firms as well as individual taxpayers can choose from a variety of action alternatives which differ according to their level of ambition to achieve a reduction in their tax burden. Building on Dyreng, Hanlon, and Maydew (2008) as well as Hanlon and Heitzman (2010), the notion of tax avoidance is broadly defined as a reduction in the tax burden through any type of strategic behavior. Emphasizing the lawfulness of a particular action, a conceptual distinction is often made between legal tax avoidance on the one hand and illegal tax evasion on the other hand (see, e.g., Slemrod & Yitzhaki, 2002; Blaufus, Braune, Hundsdoerfer, & Jacob, 2015). While the distinction between legal and illegal strategies may be clear in theory, it is often difficult to draw a clear line in practical situations (see, e.g., Alm, 2014; Blaufus et al., 2015). Hanlon and Heitzman (2010) thus suggest a continuous scale of strategies arranged according to their degree of inadmissibility, from which taxpayers choose when filing their tax returns. Activities at the lower end of the scale are characterized by using unambiguously, i.e., perfectly legal options to reduce the tax burden in order to arrive at the lowest permissible level while fully complying with both 'the letter and the spirit' of the law (Alm, 2014). An example for these activities is to use the *unambiguous deduction* for account management fees. Following Lietz (2013), this behavior is referred to as non-aggressive tax avoidance.

Engaging in activities at the upper end of the scale involves taking positions that are clearly against the law without scope for interpretation. But it is to be noted that in order to classify as tax evasion, taxpayers must also intentionally provide incomplete or incorrect information about the nature of the transaction, e.g., by hiding taxable income or deliberately claiming expenses not actually incurred (Kay, 1980, cited in Slemrod & Yitzhaki, 2002). This definition implies that it is possible for taxpayers to take clearly – i.e., 100 percent – illegal po-

sitions without being guilty of tax evasion (i.e., in cases of an unintended mistake or when taxpayers disclose their willingness to take a position that deviates from the statutory regulations).

The notion of tax aggressiveness is often used to describe tax positions lying in the center of the scale, i.e., positions with uncertain consequences which are considered increasingly aggressive the weaker the supporting facts for their admissibility are (Frischmann, Shevlin, & Wilson, 2008; Lisowsky, 2010). Lietz (2013) suggests that the degree of aggressiveness can be expressed in probabilities that a specific tax position is rejected. For the purpose of this paper, the notion of tax aggressiveness is thus defined as taking tax positions to which positive rejection probabilities are assigned. While tax aggressiveness in this sense is potentially deemed inadmissible and corrected in case of an audit, it is assumed that it will not be classified as the criminal act of tax evasion – even if the rejection probability moves towards 100% – as no criminal intent is involved. In other words, the taxpayers neither hide information nor make false statements. The treatment of the chosen approach is thus a matter of legal judgement by fiscal authorities (Lisowsky, 2010). An example for this approach is the use of the *ambiguous deduction*: The legal assessment of the deduction is uncertain; nevertheless, by using one of the common amounts described in Section 2 and potentially referring to it as "lump sum" in the tax return, taxpayers disclose their willingness to make use of it.

To sum up, just as in the case of non-aggressive tax avoidance, tax aggressive reporting behavior implies using one of several – non-criminal – action alternatives that permits maximal reduction of the tax burden. But in this case, taxpayers include tax-minimizing activities, of which the assessment by fiscal authorities is uncertain. Figure 1 illustrates taxpayers' decision alternatives on a scale of strategies becoming more and more aggressive with increasing rejection probability p_j of a potentially deductible item j.

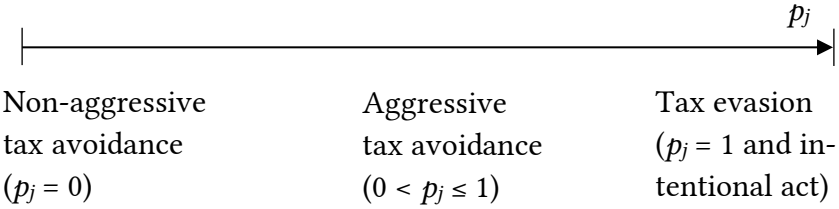

Figure 1: Scale of strategic tax reporting behavior

The above considerations suggest that uncertainty concerning the correct interpretation of rules, regulations, and other information is the underlying cause for the existence of tax aggressiveness. Only in cases where the tax system leaves room for interpretation can taxpayers choose between a more or less favorable approach and thus behave either aggressively or unaggressively. Uncertainty can in turn be attributed to complexity or to ambiguity of the tax system (Beck, Davis, & Jung, 1991; Krause, 2000). As the purpose of this study is to introduce and test the usefulness of an indicator for tax aggressiveness, it is necessary to differentiate between these two notions.

Complexity, on the one hand, is defined as a concept that makes it difficult to be aware of and understand the relevant provisions and to draw the right conclusions for one's personal situation (Beck, Davis, & Jung, 1992; Yoon, Yoo, & Kim, 2011). But it is also defined as being resolvable, i.e., in case of an audit, the tax authority discloses its definitive assessment of the situation and thus eliminates the previously prevailing uncertainty. Likewise, taxpayers can remove uncertainty due to complexity by obtaining valid information, e.g., by hiring a tax consultant (Scotchmer, 1989; Yoon et al., 2011). Ambiguity, by contrast, is defined as being irresolvable in the sense that uncertainty will remain even after an audit or consultation with a tax adviser. Tax experts as well as auditors may reach different conclusions when assessing the same tax position (Scotchmer & Slemrod, 1989; Yoon et al., 2011). Ambiguity thus means that it is unclear whether it is admissible to take an approach, which is, e.g., due to indeterminate legal notions, to a lack of information on how to proceed in order to comply with the law, to unclear or conflicting interpretations of the law, or to non-uniform training of auditors (Scotchmer & Slemrod, 1989).

In case of a binary choice, taxpayers' reaction to both complexity and ambiguity can be to choose the favorable approach. But only in cases where the tax system is ambiguous can conclusions be drawn about taxpayers' reporting aggressiveness. By contrast, reactions in case of complexity cannot be used to make this distinction. First, in complex cases where the favorable approach is legally admissible, taxpayers choosing this approach cannot be classified as aggressive; they are just aware of their right to, e.g., take a specific deduction (and can thus be classified as informed). Taxpayers choosing the unfavorable approach cannot be considered unaggressive; instead, they might simply be unable to resolve complexity (i.e., they might be classified as uninformed). Second, in complex cases where the unfavorable approach is legally admissible, taxpayers choosing the favorable approach might (1) be unable to resolve complexity and just make an unintentional mistake or (2) deliberately ignore the resolvability of complexity or the result of the resolution if the result does not match with their interest. In the latter case, they might be classified as tax evaders.

By contrast, in areas where the tax system is ambiguous, taking the favorable tax position is defined as tax aggressive behavior (Martinez, 2017). It is characterized by deliberately interpreting ambiguities in the tax system in one's favor to gain an advantage. Taxpayers not taking the favorable position are considered unaggressive. Therefore, this investigation focuses on the observation of differing behavior concerning ambiguity in the tax system as an indicator for tax aggressiveness.

The following simple model aims at clarifying the structure of taxpayers' reporting decisions in the presence of ambiguity in the tax system, and at providing an explanation for the phenomenon that some taxpayers do not exploit ambiguity even in the absence of a fine. Consider a taxpayer i with gross earnings G_i, unambiguously deductible expenses D_i and the ambiguous deduction possibility D_{amb}. It is assumed that all taxpayers claim the unambiguously legal deductions resulting in a preliminary taxable income amounting to $G_i - D_i = H_i$. In other words, they are all considered informed. The tax system is

ambiguous concerning the treatment of D_{amb}. Taxpayers thus face uncertainty about their true taxable income, which is either H_i or $G_i - D_i - D_{amb} = L_i$ (Beck & Jung, 1989; Beck et al., 1992).

Recall the scale of strategic behavior mentioned above, arranged in ascending order of the degree of inadmissibility. It is assumed that each ambiguous tax position j on this scale is assigned a specific rejection probability p_j, known by and identical for every taxpayer. Taxpayers are assumed to base their decision concerning, e.g., D_{amb} on its rejection probability, which is based on a set of information shaping the public opinion.

Additionally, taxpayers face the subjective risk of an audit with a perceived positive probability α. This probability is also assumed to be identical for all taxpayers and based on public belief. Furthermore, α is assumed to be identical for each line item of a tax return, but audits of different line items can occur independently from each other. In other words, taxpayers assume non-strategic audits of all line items due to a lack of knowledge of tax authorities' actual strategies. By contrast, it is assumed that tax authorities perform strategic audits according to the risk a specific line item bears, and the "real" audit probability for D_{amb} is zero. This results in the situation that, even after tax assessment, taxpayers are still uncertain concerning the deductibility of the *ambiguous deduction* as they are unaware of whether the line item has been audited or not. Firstly, the assumption of an actual audit probability of zero is considered realistic, as the low-valued deduction investigated in this study is assumed not to particularly attract auditors' attention. Secondly, this assumption is crucial for the empirical investigation as it is necessary to assume that the values entered in the data are unaudited in order to be able to make a valid distinction between taxpayers exploiting ambiguity and taxpayers not doing so. The potential bias resulting from this assumption is addressed in a robustness check in Section 5.3.

As mentioned above, it is assumed that a fine is not imposed in case of an audit and rejection of a tax position such as the *ambiguous deduction*.[2] Economic theory of tax compliance assumes that individuals behave rationally and maximize expected utility when deciding which income to report (Allingham & Sandmo, 1972). Consequently, all taxpayers should opt for exploiting ambiguity and choose the favorable approach, as the expected gain from claiming the deduction is positive. But empirical research on tax compliance finds that, contrary to the predictions of standard deterrence models, some taxpayers never evade, even when the evasion gamble is better than fair (e.g., Baldry, 1986; Blaufus et al., 2015; Dwenger, Kleven, Rasul, & Rincke, 2016). Likewise, the data used for this investigation show that a considerable proportion of taxpayers does not use the *ambiguous deduction*. Thus, the decision whether to exploit ambiguity or not must depend on considerations other than the pecuniary consequences. Tax compliance literature has for a long time dealt with the question why there is so little cheating. In other words, given low detection probabilities and mild penalties, the "puzzle of tax compliance" (Alm, McClelland, & Schulze, 1992, p. 21) is why most people seem to pay their taxes correctly. The same question arises for the tax saving strategy investigated in this paper.

Research on causes of high tax compliance argues that, inter alia, an intrinsic motivation for tax compliance often referred to as tax morale may influence the reporting decision (see, e.g., Frey, 1997; Alm & Torgler, 2006; Alm, Kirchler, & Muehlbacher, 2012; Alm, 2014; Dwenger et al., 2016).[3] Considerations of tax morale suggest that there are considerable differences between taxpayers' levels of intrinsic mo-

[2] Nevertheless, German taxpayers might be charged with interest on the underreported amount at the rate of 6% in case of a correction, as stated in Sec. 233a of the Fiscal Code (*Abgabenordnung*). But, as the interest payment period only starts 15 months after the date of the tax liability arising (which is the end of the year for which income tax is assessed), an interest payment will only be charged in case of delayed submission of the income tax declaration. Monetary costs as a consequence of corrected tax aggressiveness are therefore neglected.

[3] The notion of intrinsic motivation goes back to Deci (1971), who argues that "one is said to be intrinsically motivated to perform an activity when one receives no apparent reward except the activity itself" (p. 105).

tivation to comply, which may contribute to our understanding of differences in their compliance behavior (Alm, 2014; Dwenger et al., 2016). Empirical studies find a strong relationship between tax morale and compliance behavior (see, e.g., Torgler, Demir, Macintyre, & Schaffner, 2008; Halla, 2012).

Several theoretical studies of tax evasion incorporate intrinsic motivations into their models to be able to better explain high compliance rates (Gordon, 1989; Erard & Feinstein, 1994; Traxler, 2010). The models have in common that the intrinsic motivation is introduced as a costly factor – often referred to as psychic costs – which honest taxpayers incur when deviating from the social norm of compliance. In the context of tax evasion, these costs are assumed to stem from anxiety, guilt or a reduction in self-image (Gordon, 1989). In the context of tax aggressiveness, psychic costs are assumed to result from a vague feeling of exploiting a system by pushing the limits of what is permissible or acceptable and thus showing a degree of selfishness not matching the self-concept or impression a taxpayer wants to convey (Cho, Linn, & Nakibullah, 1996; Blaufus et al., 2015).

It is thus assumed that non-aggressive reporting behavior is a society's social norm, and that taxpayers have different levels of intrinsic motivation to conform with this norm. Those differences can be translated into a heterogenous rate of psychic costs c_i that taxpayers incur when deviating from norm-complying behavior. Additionally, the costs are assumed to increase with increasing p_j. In other words, the higher the perceived probability of rejection of a specific tax position, the higher the psychic costs a taxpayer incurs when choosing it. Finally, the costs are assumed to increase with increasing tax value of the difference between H_i and L_i. A taxpayer reporting L_i has the following expected after-tax income:

$$\begin{aligned} \mathrm{E}(I_{i,L}) &= (1-\alpha)(G_i - tL_i) + \alpha[(1-p_j)(G_i - tL_i) \\ &\quad + p_j(G_i - tH_i)] - c_i p_j t(H_i - L_i) \\ &= G_i - tL_i - \alpha p_j t(H_i - L_i) - c_i p_j t(H_i - L_i) \end{aligned} \tag{1}$$

If no audit occurs, the taxpayer will pay taxes on L_i. In case of an audit, the taxpayer will pay taxes on L_i with probability $(1 - p_j)$, i.e., if the tax authority decides not to reject the position. If an audit occurs

and D_{amb} is disallowed, the taxpayer will pay taxes on H_i. In any case, when claiming L_i, the taxpayer faces psychic costs amounting to $c_i p_j t(H_i - L_i)$. Taxpayers reporting H_i always arrive at an expected after-tax income $E(I_{i,H}) = G_i - tH_i$. A taxpayer will report L_i if

$$G_i - tL_i - \alpha p_j t(H_i - L_i) - c_i p_j t(H_i - L_i) > G_i - tH_i \tag{2}$$

i.e., if

$$p_j < \frac{1}{\alpha + c_i} \tag{3}$$

Condition (3) serves to define the optimal decision rule for choosing which income to report. As the rate c_i is the same for each decision a taxpayer takes and the perceived audit probability α is assumed to be identical for all taxpayers and for each line item of the tax return, the decision of a specific taxpayer to claim H_i or L_i in the case of a specific ambiguous tax position solely depends on its rejection probability p_j. The model thus suggests that taxpayers have an individual cut-off value of rejection probability p_i^*, which is higher for taxpayers with lower individual psychic costs. Taxpayers are assumed to take ambiguous positions fulfilling Condition (3), i.e., positions with rejection probabilities below their individual cut-off value ($p_j \leq p_i^*$).

Imagine two taxpayers A and B deciding which income to report. A claims D_{amb} while B does not. The rejection probability p_{amb} for the *ambiguous deduction* as well as the perceived audit probability is identical for both taxpayers. Thus, taxpayer A must have a lower rate of individual psychic costs than taxpayer B. When $c_A < c_B$, $p_B^* < p_A^*$ and $p_B^* < p_{amb} \leq p_A^*$.

A: $$p_A^* = \frac{1}{\alpha + c_A} \geq p_{amb} \tag{4}$$

B: $$p_B^* = \frac{1}{\alpha + c_B} < p_{amb} \tag{5}$$

In other words, p_{amb} lies in between the cut-off values of the two taxpayers. A is assumed to engage in ambiguous tax positions with a rejection probability as high as p_{amb} and potentially even higher. By

contrast, B will refrain from taking tax positions with rejection probabilities between their individual cut-off value p_B^* and p_{amb}.

The goal of this study is to assess whether the above definition of tax aggressiveness is applicable in a real-world context, i.e., whether the observable behavior concerning a case of ambiguity in the tax system is indicative of taxpayers' overall propensity to engage in tax-reducing behavior that can be attributed to tax aggressiveness. It is assumed that taxpayers using the *ambiguous deduction* have a higher cut-off value of rejection probability than taxpayers not using it, due to their lower rate of psychic costs. Those taxpayers will thus use more ambiguities in the tax system, namely positions with rejection probabilities lying between the cut-off values of taxpayers not using the *ambiguous deduction* and their own cut-off values. These considerations thus lead to the following hypothesis:

H1. Taxpayers using the *ambiguous deduction* arrive at a lower ETR than taxpayers not using it.

If this hypothesis holds, exploiting ambiguity in the observed field of the tax return can be used as an indicator to separate more aggressive from less aggressive taxpayers.

3.2 Determinants of the Intrinsic Motivation to Comply

In the previous section, differences in the intrinsic motivation to comply have been identified as a potential cause for differences in taxpayers' reporting behavior. This section aims to shed light on factors potentially shaping the tax morale assumed to underlie taxpayers' actions. If the behavior concerning the *ambiguous deduction* turns out to signal more or less aggressive tax reporting behavior, this result provides the opportunity to draw empirical conclusions on the direction of the link between more aggressive behavior and taxpayers' observable characteristics. The factors that literature on tax morale has discussed so far can be divided into two basic categories, namely (1) environmental factors (i.e., the influence of the behavior of and interaction with other taxpayers, tax consultants, and the tax authority) and (2) individual factors potentially affecting the judgment of certain types of behavior.

Concerning environmental factors, Alm, McClelland, and Schulze (1999) argue that one's tax morale is determined by the social norm perceived to be prevalent in society or in the taxpayer's environment. It is defined as individuals' idea of how other taxpayers will behave and how others would judge their own actions. The strength of the social norm for tax compliance in a society then determines the level of psychic costs taxpayers incur when deviating from it. Factors shaping the strength of the social norm for tax compliance are presumed to mainly lie in the relationship between taxpayers and the government and/or tax authority.[4] For instance, Alm and Torgler (2006) discuss differences in the tax morale across countries. As this study uses German tax return data to investigate tax aggressiveness, it is presumed that the observed taxpayers exhibit a uniform attitude towards the state. But it cannot be ruled out that differences in the exploitation of ambiguity stem from regional or group-specific differences in tax morale, resulting from the social surroundings of the specific taxpayer. Specifically, several studies investigating compliance behavior in Germany indicate that tax morale may vary according to taxpayers' origin either in the former West or the newlyformed German states, suggesting that tax morale is slightly higher in the newlyformed German states (Becker, 2000; Franzen, 2009).

Another environmental factor is the use of professional tax advice. As tax consultants agree to perform all tax obligations for their clients, it is reasonable to believe that the tax consultants' attitude shows in the behavior of their clients or at least exerts an influence on it. Collins, Milliron, and Toy (1990) identify three major reasons for taxpayers to hire a tax consultant: to reduce opportunity costs, to achieve tax savings, and to reduce uncertainty and ensure compliance with the law. Concerning the provision of tax savings and compliance with the law, Klepper and Nagin (1989) and Klepper, Mazur, and Nagin (1991) describe a double function of tax consultants differentiating between unambiguous and ambiguous line items. Concerning unambiguous

[4] See, e.g., Alm et al. (1999), Feld and Frey (2002), Alm and Torgler (2006), Kirchler, Hoelzl, and Wahl (2008) for studies discussing the influence of fiscal policies, enforcement regimes, perceived fairness, and cooperation and communication between taxpayer and tax authority on tax morale.

items, they find that tax consultants provide taxpayers with information they otherwise would not be aware of using their advanced knowledge of the tax code. In other words, they assist with non-aggressive tax avoidance as defined in this study. Equally, they enhance compliance regarding unambiguously illegal positions (referred to as the "enforcer effect" (Klepper et al., 1991, p. 219)). With respect to ambiguous items, Klepper and Nagin (1989) and Klepper et al. (1991) find that tax consultants assist in exploiting loopholes and ambiguous rules within the tax code (referred to as the "ambiguity-exploiter effect" (Klepper et al., 1991, p. 218)).[5] In this study, it is thus expected that tax consultants – in accordance with their mandate and as no risk of punishment is involved – do not refrain from using ambiguity due to moral reasons, but rather try and achieve the tax-optimal result for their clients. Consequently, when investigating factors determining tax aggressiveness in the sense of exploiting ambiguity, it is assumed that making use of professional tax advice promotes the propensity to claim the *ambiguous deduction*:

H2a. Taxpayers making use of a tax consultant have a higher propensity to exploit ambiguity in their favor.

Concerning individual factors, a strand of empirical literature investigated the link between demographic, financial and other socio-economic characteristics and taxpayers' tax morale (see, e.g., Alm & Torgler, 2006; Franzen, 2009; Halla, 2012). The studies show comparable results concerning standard demographic factors, in that women and older taxpayers tend to exhibit a higher tax morale. The results concerning female taxpayers are often explained in that women are found to be more cooperative and less risk-seeking (Hofmann, Voracek, Bock, & Kirchler, 2017). In this study, only the first explanation can apply as no risk of being punished is involved in the decision whether to claim an ambiguous item. Older taxpayers are assumed to

[5] The definition of ambiguous items in the studies by Klepper and Nagin (1989) and Klepper et al. (1991) slightly differs from the definition used in this study. The authors assume that a penalty can be imposed in case of rejection of the chosen approach. But they also argue that penalties in case of ambiguous items are considerably lower if based on a reasonable interpretation of the law or corresponding regulations.

be more cooperative as the need for public goods increases with increasing age (Hofmann et al., 2017). Alm and Torgler (2004) find that higher financial satisfaction is correlated with higher tax morale, suggesting that financial distress might create incentives to engage in aggressive behavior, overriding potential moral considerations. On the other hand, they find that tax morale decreases with a higher economic class. It might be concluded that higher earnings result in lower tax morale, but very low earnings might also lead to a lower tax morale. Finally, the results of the studies indicate that religious taxpayers and married taxpayers exhibit a higher tax morale (Alm & Torgler, 2006; Halla, 2012). Provided that the behavior concerning the *ambiguous deduction* results in differences in the ETR and thus signals more or less aggressive tax reporting behavior, the factors shaping the propensity to exploit ambiguity and thus to engage in aggressive reporting behavior are investigated in more detail in Section 5.4 to address the following hypotheses:

H2b. Female taxpayers have a lower propensity to exploit ambiguity in their favor than male taxpayers.

H2c. The propensity to exploit ambiguity decreases with increasing age.

H2d. The propensity to exploit ambiguity increases with increasing income but is also high for very low income due to financial constraints.

H2e. Married taxpayers have a lower propensity to exploit ambiguity in their favor.

H2f. Religious taxpayers have a lower propensity to exploit ambiguity in their favor.

4 Data Set and Preparation

The subsequent empirical investigation makes use of tax return data collected from the year 2005 of German individual income taxpayers. Data from 2005 is used to be able to analyze the influence of the existence of a professional tax consultant on an individual's propensity to

exploit ambiguity in Section 5.4. As a robustness check, the same analysis is performed for the years 2006–2010. The results of these analyses are displayed in Appendix B. The data sets used are extracts from the *Taxpayer Panel*, which in turn is based on the *Annual German Wage and Income Tax Statistics*. It is available through remote data access from the German Federal Statistical Office.[6] The data set contains around 985 variables representing almost the entirety of the line items of a tax return, thus providing detailed information on taxpayers' income components and deduction options used, as well as a variety of socio-economic information. The scientific-use version available for research purposes consists of a 5% stratified random sample of the panel, containing approximately 725,000 observations, whereby one observation either represents one single filing taxpayer or a couple consisting of two married taxpayers.

As the objective of the study is to investigate the reporting behavior of wage earners, the sample is first restricted to taxpayers receiving employment income. Additionally, taxpayers receiving income from trade and business, from agriculture or from freelance work, as well as taxpayers receiving income from renting and leasing and certain types of other income, are excluded from the sample. Proceeding in this way ensures that taxpayers in the sample are comparable in the sense that self-reported deductions related to income from employment play a particularly prominent role for them when it comes to filing the tax return to achieve a tax saving. Furthermore, for these other income types, only net earnings are provided in the data. If income is not separated into gross earnings and the related deductions, it is impossible to identify the extent to which this income has already been reduced by more or less aggressive reporting behavior and thus to quantify the impact of exploiting ambiguity on the tax burden. Consequently, the sample is restricted to taxpayers receiving only income from employment, capital gains and certain types of other income separated into gross earnings and income-related deductions in the data.

This procedure results in a preliminary sample size of 198,644 observations. During this stage of data preparation, we take a look at the

[6] Source: RDC of the Federal Statistical Office and Statistical Offices of the Länder, Taxpayer Panel, survey years 2005–2008, own calculations.

values entered in the investigated fields of the tax return, namely working tools (*WT*) and other income-related expenses (*OE*) in order to gain initial insights into the extent to which the *ambiguous* and the *unambiguous deduction* are used by taxpayers to lower their reported income. Since a preliminary inspection of the data revealed that taxpayers seem to claim the *ambiguous* and the *unambiguous deduction* or the total of both erratically in one of the two mentioned line items, the total of the two variables is calculated and referred to as additional deductions (*AD*). Table 1 displays frequency tables of the ten most frequently occurring values used by taxpayers in the area of *AD*, *WT*, and *OE*. As an observation may consist of a single filing taxpayer or a couple consisting of two married taxpayers potentially both claiming the lump sums, the data set is expanded – solely for this introductory data description – to generate one observation per taxpayer earning income from employment and thus potentially claiming the *ambiguous* and the *unambiguous deduction*.

Table 1 Most frequent values of the investigated variables
The table shows the ten most commonly occurring values and their percentage shares of the variables *WT*, *OE*, and *AD*, which constitutes the total of the two variables. The expanded sample used consists of 282,164 taxpayers.

	AD		*WT*		*OE*	
	Value	Percent	Value	Percent	Value	Percent
1	0	34.02%	0	55.92%	0	41.15%
2	16	6.62%	110	7.96%	16	23.04%
3	126	6.00%	102	4.54%	15	1.01%
4	118	3.30%	100	3.35%	126	0.94%
5	116	2.47%	103	1.96%	119	0.76%
6	119	1.95%	126	1.01%	116	0.57%
7	125	0.96%	109	0.84%	118	0.46%
8	100	0.55%	118	0.69%	222	0.37%
9	110	0.47%	120	0.67%	30	0.34%
10	136	0.47%	150	0.60%	100	0.23%

The use of both lump sums is clearly visible in the data, and taxpayers using them in either of the two line items seem to constitute a major proportion of the observed taxpayers. Focusing on *AD*, it can be observed that whereas the most frequently occurring value is 0 (i.e., approx. 34% of the taxpayers do not claim any working tools or other

income-related expenses), the second most frequently occurring value is 16 (claimed by approx. 6.6%), showing that a large proportion of taxpayers is aware of and using the lump sum for account management fees (*unambiguous deduction*). The third to seventh most common values are assumed to show a combination of the *unambiguous deduction* amounting to EUR 16 or EUR 15 and the *ambiguous deduction* for working tools of a value around EUR 110. The same is true for the tenth most common value, whereas numbers 8 and 9 show the *ambiguous* without the *unambiguous deduction*.

At this stage of data preparation, a potential indicator for more or less aggressive reporting behavior is proposed. Taxpayers are classified into one of two groups according to their behavior regarding the use of the two lump sums. The binary variable "reaction to ambiguity" RA_i is generated to indicate whether a taxpayer makes use of the lump sums of interest in order to lower their reported income.

$$RA_i = \begin{cases} 1, & \text{if } i \text{ claims both deductions} \\ 0, & \text{if } i \text{ does not claim both deductions} \end{cases} \tag{6}$$

In order to be classified in the treatment group of taxpayers exploiting ambiguity in their favor, it is required that a single filing taxpayer or spouse claims both the *ambiguous* and the *unambiguous deduction*, i.e., both a value of around EUR 110 for working tools and a value of EUR 15 or EUR 16 for account management fees. The goal is to capture taxpayers being informed about both lump sums in the area of additional income-related deductions and, besides using the perfectly legal one, also deciding to exploit ambiguity in that area. For the latter lump sum, a range between EUR 100 and EUR 120 is used to cover all relevant values and to account for the presumption that taxpayers exploiting ambiguity tend to increase the claimed value over time in order to test and push the limits of the fiscal authorities. The variable RA_i is denoted as 1 if both lump sums are identified in the sum of the two line items observed, thus, if the single-filing taxpayer or at least one wage-earning spouse claims a value between EUR 115 and EUR 136 of *AD*. It is denoted as 0 if a taxpayer or neither of the two spouses claims an amount within the identified range of values.

$$RA_i = \begin{cases} 1, & \text{if } 115 \leq AD_i \leq 136 \\ 0, & \text{otherwise} \end{cases} \tag{7}$$

In the next step, in order to avoid problems resulting from missing data, taxpayers claiming income-related deductions (*IRD*) not exceeding the standard deduction (*SD*) of EUR 920 are removed from the sample. As, for these taxpayers, using the investigated lump sums does not result in any additional tax saving, they have no incentive to enter either the *unambiguous* or the *ambiguous deduction* into their tax return. An inspection of the data shows that a large proportion of taxpayers making use of the *SD* do not enter any *IRD*. Thus, it cannot be assessed whether these taxpayers do have any expenses or not, or whether they would use the *ambiguous deduction* if this would result in an actual financial benefit. The data set thus suffers from missing values in that area. As, in the case of jointly filed returns, each spouse is entitled to his or her individual *SD*, the observation is excluded if none of the wage-earning spouses exceeds the *SD*. The study thus focuses on taxpayers for whom every additional EUR of *IRD* results in an additional amount of tax saving.

Finally, in order to guarantee a meaningful sample and group assignment, taxpayers are removed from the sample if they claim *AD* above the sum of the *ambiguous* and the *unambiguous deduction*. Otherwise, if a taxpayer claims, e.g., *AD* in the amount of EUR 500, it is impossible to determine whether the investigated lump sums are included in that amount. The analysis thus focuses on taxpayers that do not actually incur (verifiable) higher expenses in the area of *AD*. Concerning jointly filing taxpayers, the observation remains in the sample if at least one of the wage-earning spouses claims *AD* not exceeding the identified lump sums. If the observation remains in the sample because of both spouses, group membership depends on whether at least one of them uses the *ambiguous* and the *unambiguous deduction*. In this case, the couple is classified as “exploiters of ambiguity”.

This procedure results in a final sample size of 59,619 observations, and taxpayers in this sample either claim the sum of the *ambiguous* and the *unambiguous deduction*, zero or a positive amount below the investigated lump sums. Concerning the two latter groups of taxpayers, it is – according to the considerations in Section 3.1 – assumed

that they prefer not to take the ambiguous tax position, as the corresponding rejection probability exceeds their individual cut-off value p^*. Table 2 describes the construction of the final sub-sample and Table 3 again displays the most frequently occurring values in the investigated fields based on the final sub-sample.

Table 2 Construction of the sub-sample

	No. of obs.
5% TPP	727,368
TP without employment income	184,059
TP with business income	341,255
TP with income below the basic tax-free amount	3,410
Sub-sample	198,644
TP claiming *IRD* below *SD*	81,235
TP claiming *AD* above the investigated lump sums	57,790
Final sub-sample	59,619

Table 3 Most frequent values of the investigated variables (final sample)
The table shows the most commonly occurring values and their percentage shares of the variables *AD*, *WT*, and *OE*. The sample used consists of 90,313 taxpayers.

	AD		*WT*		*OE*	
	Value	Percent	Value	Percent	Value	Percent
1	0	0.2151	0	0.4982	16	0.4484
2	126	0.1448	110	0.1266	0	0.3223
3	16	0.1320	102	0.0772	126	0.0200
4	118	0.0834	100	0.0631	15	0.0191
5	116	0.0626	103	0.0332	119	0.0156
6	119	0.0475	126	0.0167	116	0.0104
7	125	0.0224	109	0.0163	118	0.0097
8	136	0.0115	118	0.0121	30	0.0041
9	100	0.0108	120	0.0111	100	0.0030
10	115	0.0106	116	0.0091	125	0.0030

We can thus take a first look at the distribution of the binary variable *RA*: In the year 2005, 54.82% of the taxpayers in the final subsample are classified as exploiters of ambiguity, using both the *unambiguous* and the *ambiguous deduction* to lower their reported income. 45.18% do not claim both investigated deductions and thus do not use all possibilities to lower their tax burden.

5 Estimation and Results

5.1 Effect of Exploiting Ambiguity on the Tax Burden

The success of taxpayers' attempt to reduce their tax burden is assessed using an effective tax rate measure. The ETR is commonly applied and well accepted as a measure of tax avoidance (Hanlon & Heitzman, 2010), capturing taxpayers' outcome including the tax-reducing effect of all kinds of strategic behavior. Two variations of this measure are used in order to (1) quantify the effect of exploiting ambiguity on the ETR, including the direct tax-reducing effect of deducting the investigated amounts, and (2) measure the effect independent from the direct influence of claiming the lump sums. In the first setting, the outcome variable ETR_i is defined as follows: The numerator consists of taxpayers' income tax to be assessed. As taxable income is already influenced by differing tax reporting behavior, the denominator consists of taxpayers' gross earnings G_i in order to avoid a feedback effect. This results in the following outcome variable:

$$ETR_i = \frac{t(TI_i)}{G_i} \tag{8}$$

where $t(\cdot)$ is the progressive German income tax function. In the second setting, the numerator of the effective tax rate measure is a modified version of taxpayers' income tax to be assessed $t(TI_{corr,i})$. Since the objective is to investigate whether the fact that a taxpayer exploits ambiguity in the investigated field may serve as an indicator for more aggressive reporting behavior in general, the direct tax-reducing effect of claiming the lump sums or a lower amount in the area of additional income-related deduction is neutralized by correcting taxpayers' taxable income by their level of AD_i. In other words, the claimed *ambiguous* and *unambiguous deduction* if $RA_i = 1$ or the lower

amount potentially claimed if $RA_i = 0$ are added back to taxable income. Additionally, it is necessary to consider whether taxpayers still exceed the *SD* with their remaining income-related deductions (IRD_i) after the relevant amount of AD_i has been added. If correcting for AD_i leads to income-related deductions below the *SD*, the *SD* is used instead. After correcting the taxable income, taxpayers' income tax is re-calculated based on this adjusted income level. This results in the following corrected effective tax rate measure:

$$ETR_{corr,i} = \frac{t(TI_{corr,i})}{G_i} \tag{9}$$

with

$$TI_{corr,i} = TI_i + \min(AD_i; IRD_i - SD) \tag{10}$$

Inspecting the distribution of the binary treatment variable revealed that some taxpayers use the *ambiguous deduction* while others don't. The hypothesis is that taxpayers using the *ambiguous deduction* arrive at a lower ETR_i and also (to a lesser extent) at a lower $ETR_{corr,i}$ than taxpayers not using it. If this is the case, the conclusion is drawn that exploiting ambiguity in the investigated field may serve as an indicator for more aggressive tax reporting behavior. The effect of exploiting ambiguity on the effective tax rate of individual *i* can be formalized as follows:

$$\tau_i = ETR_i(RA_i = 1) - ETR_i(RA_i = 0) \tag{11}$$

where $ETR_i(RA_i = 1)$ denotes the outcome with treatment, $ETR_i(RA_i = 0)$ denotes the outcome without treatment and RA_i denotes the treatment status. However, only one outcome is observed for each taxpayer, and it is thus impossible to estimate the treatment effect at an individual level (Roy, 1951; Rubin, 1974). Thus, to assess the impact of the treatment, one must rely on average treatment effects on the entire population by substituting the unobservable *ETR* of a treated taxpayer in case they are untreated by the mean outcome of subjects not experiencing the treatment.

It would be possible to simply compare the mean *ETR* of taxpayers using the *ambiguous deduction* to the mean *ETR* of taxpayers not using it. But this result is only valid if, in the absence of the former taxpayers' exploiting reaction to ambiguity, one could expect the same outcome for the two subpopulations (Caliendo & Kopeinig, 2008). In the present setting using observational data, taxpayers deliberately choose whether to claim the *ambiguous deduction* or not – they self-select into the treated and untreated groups – and that choice is assumed to be influenced by other observable characteristics which may also affect the level of the *ETR*. In other words, the two groups may differ with regard to certain characteristics, and observable differences in outcome may stem from the differences in those characteristics. As the goal is to extract the influence of exploiting ambiguity in the investigated field on the level of the *ETR*, it is crucial that the applied method allows for an interpretation of the identified treatment effect as causal. I.e., the observed effect must be attributable to the treatment and other factors need to be ruled out. A mere comparison of the treatment and control group would be biased in the sense that it is not possible to determine whether an observed difference in the average outcomes is attributable to the treatment or to inherent group differences (Liu, 2016).

Consequently, propensity score matching is used to eliminate the impact of taxpayers' characteristics assumed to influence the participation decision and the outcome variable (Rosenbaum & Rubin, 1983). The procedure is based on the idea of constructing a control group that matches the treatment group in all relevant characteristics by matching on one single balancing score that is a function of those characteristics and defined as the probability of treatment assignment conditional on those factors. In order to calculate the propensity scores, a logistic regression is estimated using the treatment variable *RA* as the dependent variable.

Concerning the choice of covariates in the propensity score model, a wide variety of factors are assumed to jointly influence the propensity of a taxpayer to claim the *ambiguous deduction* and the level of their *ETR*. Firstly, it is individual factors potentially shaping the tax morale that may influence both a taxpayer's propensity to use the *ambiguous deduction* and their *ETR*. If using the *ambiguous deduction* is

indicative of aggressiveness, the same factors that are assumed to lead to a reduced *ETR* through aggressive behavior are also factors influencing the propensity to claim the ambiguous item. If it is, e.g., assumed that younger taxpayers behave more aggressively than older taxpayers as suggested by compliance literature, being young might (positively) influence the individual's probability to use the *ambiguous deduction* and (negatively) influence the level of their *ETR*. Propensity score matching is thus used to exclude that it is being young that leads to a higher level of aggressiveness and a reduced tax burden. Matching on all potential determinants of the intrinsic motivation to comply discussed in Section 3.2 (i.e., gender, age, income level and marginal tax rate, marital status, and religious denomination) allows the comparison between the *ETR* of a taxpayer claiming the *ambiguous deduction* and the *ETR* of a comparable taxpayer not claiming the *ambiguous deduction* and thus permits to investigate whether exploiting ambiguity in the investigated field results in a lower *ETR*. Further observable socio-economic characteristics (i.e., taxpayers' origin and the existence of children) are additionally included in the model.

Secondly, it is assumed that the environmental factor of professional tax advice both affects the level of the *ETR* (Kittl, 2015; Blaufus, Hechtner, & Möhlmann, 2017) and – as discussed in Section 3.2 – the propensity to use the ambiguous item (Klepper & Nagin, 1989; Klepper et al., 1991).

Furthermore, the complexity of the tax situation of a specific taxpayer is assumed to affect both their *ETR* and the propensity to claim the *ambiguous deduction*, as taxpayers in a more complex tax situation must deal with tax issues to a greater extent. This may increase their propensity to make use of ambiguity due to frustration, and may also lead to a reduced *ETR* due to the higher effort involved. Therefore, variables indicating the complexity of a taxpayer's situation are incorporated as covariates in the logistic regression model. These include the existence of further income types besides income from employment as well as the existence of different types of income-related and other deductions (i.e., special expenses besides common social security contributions, and exceptional costs). Finally, to cope with the survey design of the data, sampling weights are also integrated in the model as a covariate (DuGoff, Schuler, & Stuart, 2014). The regression itself

is unweighted (Zanutto, 2006). Assessing correlation coefficients and variance inflation factors does not point to problems with collinearity, indicating a mean VIF of 1.5 for the fiscal year 2005.

The matching covariates used are described in Table 4. Table 5 summarizes descriptive statistics of the weighted final sample, including the treatment and outcome variables and all variables used as matching covariates. The results of the unweighted logistic regression are displayed in Table A.1 in Appendix A.

Table 4 Matching covariates

Group	Variable	Description and Operationalization
Individual	*GENDER*	Binary variable, one if the taxpayer is a single-filing female
	MWA	Married Wage A: Binary variable, one if the observation consists of two married taxpayers and only the husband or first-mentioned partner earns income from employment
	MWB	Married Wage B: Binary variable, one if the observation consists of two married taxpayers and only the wife or second-mentioned partner earns income from employment
	MDW	Married Double Wage: Binary variable, one if the observation consists of two married taxpayers and both earn employment income
	ORIGIN	Binary variable, one if the taxpayer or the married couple is located in the newlyformed states of Germany
	AGE	Age in years
	CHILDREN	Binary variable, one if the taxpayer or the married couple has at least one child
	RELIGION	Binary variable, one if the taxpayer or at least one spouse is a church member
	GI	Gross earnings (in thousands of euros)
	GI^2	Gross earnings (in thousands of euros) squared
	MTR	Marginal tax rate

Environmental	TC	Binary variable, one if the taxpayer or the married couple makes use of a tax consultant
Complexity	INC_{Cap}	Binary variable, one if capital income exists
	INC_{Other}	Binary variable, one if other income exists
	DED_{House}	Binary variable, one if the taxpayer or at least one spouse claims expenses for running two households necessary for employment
	DED_{Travel}	Binary variable, one if the taxpayer or at least one spouse claims expenses for travelling between home and work place
	$DED_{Victuals}$	Binary variable, one if the taxpayer or at least one spouse claims subsistence allowances when travelling for work
	DED_{Extra}	Binary variable, one if the taxpayer or at least one spouse claims costs of a home office, costs of membership in a professional organization or work-related childcare costs
	SE_{Extra}	Binary variable, one if the taxpayer or the spouses claim special expenses for alimony, annuity or education
	EC	Binary variable, one if the taxpayer or the spouses claim exceptional costs (e.g., resulting from an illness or disability)
Sampling weight	SW	Sampling weight

Table 5 Descriptive statistics (weighted sample)

Group	Variable	Mean	SD
Treatment	*RA*	0.5482	0.3684
Outcome	*ETR*	0.1227	0.0465
	ETR_{corr}	0.1233	0.0465
Matching Covariates			
Individual	*GENDER*	0.1355	0.2533
	MWA	0.2106	0.3018
	MWB	0.0221	0.1089
	MDW	0.4309	0.3666
	ORIGIN	0.1671	0.2762
	AGE	43.0033	7.2057
	CHILDREN	0.5091	0.3701
	RELIGION	0.6075	0.3615
	GI	45.9553	18.0169
	GI^2	2,704.28	10,366.54
	MTR	0.3605	0.0418
Environmental	*TC*	0.1559	0.2685
Complexity	INC_{Cap}	0.0387	0.1427
	INC_{Other}	0.0332	0.1326
	DED_{House}	0.0196	0.1025
	DED_{Travel}	0.9825	0.0972
	$DED_{Victuals}$	0.1537	0.2670
	DED_{Extra}	0.3039	0.3405
	SE_{Extra}	0.0277	0.1216
	EC	0.2072	0.3000

After estimating the propensity scores, nearest neighbor matching with replacement is used to generate a valid control group. Matching is carried out using the Stata module psmatch2 (Leuven & Sianesi, 2003). To avoid bad matches, a caliper width of 0.2 of the pooled standard deviation of the logit of the propensity score is used as recommended by Austin (2011). Table A.2 in Appendix A displays two different diagnostics of covariate balancing (i.e., the pseudo-R^2 and the mean standardized bias before and after matching), both indicating a good matching quality. Matching reduces the sample size to 59,606 observations. Subsequently, weighted means are calculated, and

t-tests are performed. The treatment effects are calculated for both outcome variables and displayed in Table 6.

Table 6 Average treatment effects
The table presents the average treatment effects of treatment variable *RA* on the levels of the *ETR* and ETR_{corr} for the fiscal year 2005.

	Mean	Treated	Un-treated	Δ	SE	p>|t|
ETR	0.122717	0.118276	0.128104	−0.009829	0.000580	0.0000
ETR_{corr}	0.123370	0.119103	0.128326	−0.009223	0.000581	0.0000

The average *ETR* in the matched sample amounts to 12.27%. Adjusting for the direct influence of claiming the lump sums or a lower amount in the area of additional income-related deductions leads to a slightly increased mean ETR_{corr} amounting to 12.33%, suggesting that the deductions in the area of *AD* lead to an average reduction in the effective tax rate amounting to 0.0653 percentage points. Focusing on the comparison between the treatment and control group, the results indicate that taxpayers making use of both the *ambiguous* and the *unambiguous deduction* arrive at a significantly lower *ETR* and ETR_{corr} than the control group. Whereas the mean *ETR* of taxpayers not using the *ambiguous deduction* amounts to 12.81%, the mean *ETR* of taxpayers exploiting ambiguity in the investigated field amounts to 11.83%, resulting in a treatment effect of −0.9829 percentage points. Correcting for the direct effect of the claimed *AD*, the treatment effect is reduced by 0.0606 percentage points. Whereas the adjustment leads to an increase in the mean effective tax rate of taxpayers choosing the *ambiguous deduction* by 0.0827 percentage points, the *ETR* of taxpayers not exploiting ambiguity increases only by 0.0222 percentage points, which is due to the higher amount claimed by the former group. Thus, comparing the adjusted outcome variable ETR_{corr} of taxpayers using ambiguity with that of taxpayers not doing so shows a significant treatment effect of −0.9223 percentage points. In other words, regardless of the difference resulting from the direct effect of deducting the investigated lump sums, taxpayers using the *ambiguous* and the *unambiguous deduction* arrive at a significantly lower tax burden than taxpayers not using the deduction, with the treatment effect

amounting to a multiple of the tax-reducing effect of the investigated lump sums.

Tables B.1–B.5 in Appendix B present the results of the same analysis for the fiscal years 2006–2010. The analyses only differ in that the existence of a tax consultant cannot be investigated as – due to a tax law change – the corresponding expenses are no longer tax deductible, and the existence of a tax consultant is thus no longer visible in the data. Matching is thus performed without using the variable *TC* as a covariate. The results indicate that for each of the investigated years, a negative treatment effect is visible in the data, ranging from −0.9904 to −1.2852 percentage points for the *ETR* and from −0.9302 to −1.2267 percentage points for the ETR_{corr}. The results thus provide initial support for the hypothesis that the use of the *ambiguous deduction*, i.e., reacting to ambiguity by choosing the favorable approach, may serve as an indicator for more aggressive tax reporting behavior.

5.2 Control for Non-Aggressive Tax Avoidance

As mentioned above, the ETR quantifies differences in the tax burden between the treatment and control group, irrespective of the causes leading to them. In the matched sample, differences resulting from observable factual reasons (e.g., from different income levels) are ruled out and remaining discrepancies point to the treatment group engaging in a higher level of tax avoidance in the sense of the successful attempt to reduce the tax burden through any type of strategic behavior. But the observable effects resulting from these behavioral strategies emerge in a cumulative way, i.e., irrespective of whether they stem from non-aggressive tax avoidance or tax aggressiveness as defined in Section 3.1 or even from activities that can be qualified as tax evasion. The conclusion that can be drawn from the above results is thus rather that taxpayers using the *ambiguous* and the *unambiguous deduction* seem to be more inclined to lower their tax burden through any type of strategic behavior. As the goal is to investigate whether differences in dealing with ambiguity lead to differences in the level of tax that can be attributed to tax aggressiveness, it must be ruled out that other behavioral differences between both groups affect the level

of tax. In the next step, it is thus aimed to eliminate potential distortions resulting from differences in non-aggressive tax avoidance.[7]

The previous setting implicitly assumes that taxpayers in the control group deliberately decide against claiming the *ambiguous deduction* due to the level of psychic costs they would incur when doing so. This might not be the case for all of these taxpayers. An alternative explanation for the membership in the control group is that these taxpayers are just not aware of the ambiguous item. They might therefore rather be classified as uninformed than unaggressive and no conclusion about their propensity for reporting aggressiveness can be drawn from the above results. In the following, taxpayers' behavior regarding the second lump sum introduced in Section 2 and referred to as the *unambiguous deduction* is used to make a further distinction between taxpayers with respect to their use of non-aggressive tax avoidance.

Building on the terminology introduced in Section 3.1, tax complexity has been defined as the resolvable difficulty to be aware of and understand the relevant tax provisions and to draw the right conclusions for one's personal situation (Beck et al., 1992; Yoon et al., 2011). Tax complexity is thus identified as the underlying cause for taxpayers to potentially not engage in non-aggressive tax avoidance to the extent they are entitled to. In other words, whereas differences in tax aggressiveness have been attributed to differences in dealing with ambiguity, differences in non-aggressive tax avoidance are assumed to result from differences in dealing with complexity. The *unambiguous deduction* represents a complex case in the tax system where the favorable approach is legally admissible. Taxpayers who claim the *unambiguous deduction* are thus assumed to generally engage in non-aggressive tax avoidance in the sense of informing themselves about tax-reducing options beyond what is explicitly queried in the tax return and arranging their affaires as to pay the lowest amount of legally

[7] As tax evasion is not observable in the data, it cannot be ruled out that taxpayers making use of ambiguity also use criminal methods to reduce their tax burden and that differences between treatment and control group are partially due to differences in tax evasion.

owed taxes. By contrast, taxpayers not claiming the *unambiguous deduction* are considered unable or unwilling to master complexity in this sense. Taxpayers' reaction in this case of complexity is thus used as the distinguishing criterion between taxpayers who are generally informed about unambiguously legal tax-reducing options and taxpayers who are uninformed. More importantly, it is assumed that taxpayers who are informed about the *unambiguous deduction* are also informed about the possibility to use the *ambiguous deduction* as the lump sums are considered similar in that they relate to the same subject and in that the effort to become aware of them is equally high.

In the light of these considerations, the scale of strategic behavior and the model introduced in Section 3.1 are extended to include taxpayers not making use of non-aggressive tax avoidance to the extent they are entitled to. In Section 3.1, taxpayers have been assumed to either claim $G_i - D_i = H_i$ or $G_i - D_i - D_{amb} = L_i$. But, as the tax system is complex, determining D_i is associated with the effort of being aware and understanding the relevant provisions. Taxpayers who are not willing or able to make this effort are assumed to claim their gross income G_i or, more realistically, an amount between G_i and H_i, thus foregoing the tax-reducing effect of the full amount of D_i. The *unambiguous deduction* D_{unamb} is defined as being part of D_i and taxpayers' behavior in that area is used representatively to distinguish between taxpayers engaging in non-aggressive tax avoidance and taxpayers not doing so. The rationale concerning the decision between H_i and L_i as presented in Section 3.1 does not change due to these considerations as the effort necessary to be aware of both lump sums is assumed to be identical and thus irrelevant for the decision.

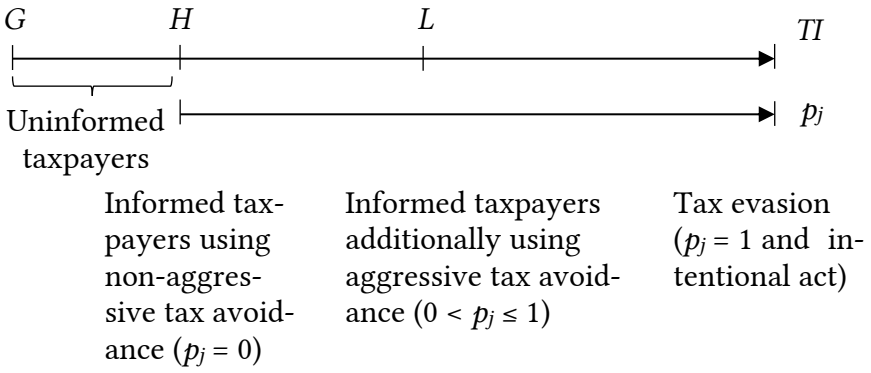

Figure 2: Extended scale of tax reporting behavior

The control group used in the empirical analysis in Section 5.1 is thus further subdivided according to taxpayers' behavior regarding D_{unamb}, leading to three groups of taxpayers. Taxpayers not claiming neither the *ambiguous* nor the *unambiguous deduction* are classified as uninformed. Taxpayers claiming the *unambiguous* but not the *ambiguous* deduction are classified as informed. Informed taxpayers are assumed to make a conscious decision to refrain from exploiting ambiguity. The third group of taxpayers claim both lump sums and thus choose to use ambiguity in their favor.

Two treatment variables are used for this refined analysis. The variable $RA_{corr,i}$ is denoted as 1 if both lump sums are claimed. In contrast to the operationalization of RA_i in Section 5.1, it is denoted as 0 if a taxpayer claims AD_i at least in the amount of D_{unamb} but below the sum of both deductions. Those taxpayers are assumed to claim expenses they actually incurred by engaging in non-aggressive tax avoidance, but to not exploit ambiguity.

$$RA_{corr,i} = \begin{cases} 1, & \text{if } 115 \leq AD_i \leq 136 \\ 0, & \text{if } 15 \leq AD_i < 115 \end{cases} \tag{12}$$

A second binary treatment variable is introduced, referred to as INF_i and serving to capture taxpayers informedness concerning unambiguously legal tax avoidance options. It is denoted as 1 if a taxpayer claims AD_i at least in the amount of D_{unamb} but below the sum of both deductions. It is denoted as 0 if taxpayers do not claim any AD_i or an amount below the *unambiguous deduction* of EUR 15.

$$INF_i = \begin{cases} 1, & \text{if } 15 \leq AD_i \leq 115 \\ 0, & \text{if } AD_i < 15 \end{cases} \tag{13}$$

Matching is executed pairwise using two different samples and comparing informed taxpayers to exploiters of ambiguity and uninformed to informed taxpayers. Concerning the first comparison, this approach aims at ruling out the alternative explanation of taxpayers' lack of knowledge by making sure that not claiming the *ambiguous deduction* results from a deliberate choice of the taxpayers in the control group. The hypothesis is that interpreting ambiguous information in one's favor leads to an additional tax saving compared to being informed but refraining from using ambiguity. The second comparison is additionally performed. In this regard, it is hypothesized that uninformed taxpayers pay a premium on their legally owed tax liability and thus arrive at a higher *ETR* than taxpayers who are informed in the sense of being able and willing to master complexity.[8]

H3. Taxpayers who are classified as informed arrive at a lower ETR than taxpayers classified as uninformed.

For the fiscal year 2005, the matched sample for testing the difference in outcome between informed taxpayers and exploiters of ambiguity consists of 50,824 observations, of which 63.27% are classified in the treatment group and 36.73% are classified in the control group. The matched sample for testing the difference between informed and uninformed taxpayers consists of 28,835 observations, of which 70.39% are classified as informed and 39.61% are classified as uninformed. The treatment effects are calculated for both treatment and both outcome variables and displayed in Table 7.

[8] This hypothesized premium is referred to as *Dummensteuern* ("fool's taxes") in German tax research (Rose, 1995; p. 153). "Fool's taxes" are defined as the additional tax burden that would not occur if taxpayers' had achieved the same economic goal optimally using their options for legal tax avoidance. Wagener (2001) shows that their occurrence can only be prevented by establishing a tax system that uses a linear tax rate function and is devoid of any options.

Table 7 Average treatment effects
The table presents the average treatment effects of treatment variable RA_{corr} and treatment variable *INF* on the levels of the *ETR* and ETR_{corr} for the fiscal year 2005.

	Mean	Treated	Un-treated	Δ	SE	p>|t|
RA_{corr}						
ETR	0.121791	0.118277	0.127844	−0.009567	0.000641	0.0000
ETR_{corr}	0.122430	0.119104	0.128157	−0.009053	0.000641	0.0000
INF						
ETR	0.128103	0.127841	0.128725	−0.000884	0.000986	0.3700
ETR_{corr}	0.128324	0.128155	0.128726	−0.000571	0.000986	0.5630

The main result of this refined analysis is that taxpayers using ambiguity in their favor arrive at a significantly lower *ETR* and ETR_{corr} than taxpayers classified as informed. Focusing on the adjusted outcome variable ETR_{corr}, the average effective tax rate in the matched sample amounts to 12.24%. Whereas taxpayers making use of both deductions arrive at an ETR_{corr} amounting to 11.91%, the control group of taxpayers not fully exploiting ambiguity arrive at an ETR_{corr} amounting to 12.82%, indicating a negative treatment effect of −0.9053 percentage points. I.e., the treatment effect decreased compared to the result of the initial analysis in Section 5.1, which has shown a treatment effect amounting to −0.9223 percentage points. This decrease suggests that a small share of the treatment effect observed in Section 5.1 is attributed to differences in non-aggressive tax avoidance between the initial treatment and control group.

Performing the same analysis for fiscal years 2006–2010 (results are displayed in Table B.6 in Appendix B) produces similar results with respect to treatment variable RA_{corr}: A significant negative treatment effect is observed in each year, ranging from −0.9522 to −1.2027 percentage points for the *ETR* and from −0.9011 to −1.1533 percentage points for the ETR_{corr}. The results provide additional support for hypothesis H1 and the assumption that taxpayers claiming the *ambiguous deduction* have a higher individual cut-off value of rejection probability p_i^* compared to taxpayers not claiming it due to the lower level of psychic costs they incur when exploiting ambiguity. It is concluded

that the reduced tax burden results from them claiming other ambiguous positions with rejection probabilities as high as p_{amb} and potentially even higher. By contrast, taxpayers not claiming D_{amb} refrain from taking uncertain tax positions with rejection probabilities between their lower individual cut-off value and p_{amb}. The results thus indicate that individuals' reaction to ambiguity in a specific field can serve as an indicator to distinguish more from less aggressive taxpayers.

By contrast, comparing the ETR and ETR_{corr} of uninformed and informed taxpayers for the fiscal year 2005 and additionally for 2006–2010 (Table B.6 in Appendix B) yields mixed results. In each year, a negative treatment effect is observed which is insignificant for the years 2005 and 2006, significant at the 5% level for the years 2007 and 2009, and significant at the 1% level for the years 2008 and 2010. Overall, slight indications can be found for the existence of a premium on the legally owed tax burden as a consequence of an inefficient use of all available tax-reducing options, but no clear statement can be made regarding H3.

5.3 Control for Potential Bias from State Differences

In the previous sections, it has been assumed that tax authorities perform strategic audits on different line items of a tax return, depending on the risk a specific line item bears. As the financial implication of the *ambiguous deduction* is rather low, the audit probability for the lump sum has been assumed to equal zero and the data in this area thus to be unaudited. This assumption is crucial to be able to make a valid distinction between taxpayers exploiting ambiguity and taxpayers not doing so. However, it is a strong assumption and it cannot be ruled out that tax authorities disallow and correct the *ambiguous deduction* despite its marginal financial impact. Therefore, in order to at least partially rule out distortions resulting from incorrect group assignment, the analysis is repeated only including a reduced sample of taxpayers located in federal states of Germany that are assumed to be particularly generous respectively indifferent concerning the deduction of the ambiguous lump sum.

In general, taxes shall be assessed and collected uniformly across the different federal states of Germany as required by the principle of equality in taxation (derived from Art. 3 of the German Constitution). Nevertheless, and since administration of the income tax is in the responsibility of the federal states (Art. 108 Par. 3 of the German Constitution), differences concerning the interpretation and enforcement of the law cannot entirely be ruled out. Recall the statements made by different Regional Tax Offices mentioned in Section 2 concerning the deductibility of the ambiguous item: They indicate that tax authorities in the newlyformed German states are more restrictive concerning the *ambiguous deduction* than the tax authorities in the old West German states. This presumption seems to correspond with the available data: Assessing the distributions of the treatment variable *RA* per federal state (Table A.4 in Appendix A), clear differences between eastern and western states of Germany become apparent. Whereas in the western states of Germany, approximately 58.42% claim the *ambiguous deduction* in 2005, only about 36.88% of the taxpayers in the eastern states of Germany do so. There are two possible explanations for this discrepancy: On the one hand, it is possible, as suggested in Section 3.2, that taxpayers from different regions or social surroundings exhibit different levels of tax morale showing in the proportions of taxpayers claiming the *ambiguous deduction*. Compliance literature in Germany suggests that taxpayers from the newlyformed states of Germany exhibit a higher tax morale than taxpayers from the old West German states, possibly justified in terms of previous historical circumstances (Becker, 2000; Franzen, 2009). On the other hand, the difference may result from a stricter assessment of the *ambiguous deduction* in the eastern states of Germany, leading to corrections of the tax return in case of its use. In this case, the results of the above analyses may be distorted as East German taxpayers who should be classified as exploiters of ambiguity are classified in the control group as their tax returns have been audited and corrected.

Therefore, the analysis is repeated focusing on taxpayers located in the western states of Germany, as it is assumed that their tax returns are more likely to be unaudited in the area of the *ambiguous deduction*. For the fiscal year 2005, the matched sample for testing the difference in outcome between informed taxpayers and exploiters of ambiguity

consists of 43,128 observations, of which 67.1% are classified in the treatment group and 32.9% are classified in the control group. The matched sample for testing the difference between informed and uninformed taxpayers consists of 22,929 observations, of which 68.73% are treated and 31.27% are untreated.

If the above considerations apply, it is expected that the treatment effect when comparing informed taxpayers to exploiters of ambiguity is even more pronounced than in the previous sections. By contrast, the treatment effect comparing uninformed to informed taxpayers should decline. The rationale is that taxpayers who should be classified in the group of exploiters of ambiguity have been classified as informed taxpayers in the analysis in Section 5.2. Those taxpayers are assumed to arrive at a lower *ETR* than the taxpayers who are rightly classified as informed. Consequently, this potential distortion decreases the difference in *ETR* between informed taxpayers and exploiters of ambiguity while increasing the difference between uninformed and informed taxpayers. Again, the treatment effects are calculated for both treatment and both outcome variables and displayed in Table 8.

Table 8 Average treatment effects
The table presents the average treatment effects of treatment variable RA_{corr} and treatment variable *INF* on the levels of the *ETR* and ETR_{corr} for the fiscal year 2005 focusing on taxpayers located in the western states of Germany.

	Mean	Treated	Un-treated	Δ	SE	p>|t|
RA_{corr}						
ETR	0.126404	0.121738	0.135923	−0.014185	0.000693	0.0000
ETR_{corr}	0.127068	0.122569	0.136245	−0.013676	0.000693	0.0000
INF						
ETR	0.135659	0.135922	0.135081	0.000842	0.001065	0.4290
ETR_{corr}	0.135881	0.136244	0.135081	0.001163	0.001065	0.2750

As expected, the results show even more pronounced negative treatment effects when comparing informed taxpayers to exploiters of ambiguity, amounting to −1.3676 percentage points when focusing on ETR_{corr}. The results for the fiscal years 2006–2010, displayed in Table B.7 in Appendix B, indicate negative treatment effects ranging from −1.4277 to −1.8047 percentage points for the *ETR* and from −1.3803 to −1.7560 percentage points for the ETR_{corr}. I.e., when focusing on tax

returns for which the assumption that the *ambiguous deduction* is unaudited is more likely to hold than for the whole sample, the results strengthen as expected. The analysis thus provides further support for hypothesis H1, suggesting that the use of the *ambiguous deduction*, i.e., reacting to ambiguity by choosing the favorable approach, may serve as an indicator for more aggressive tax reporting behavior.

By contrast, no significant difference is observable when comparing uninformed to informed taxpayers. As expected, the negative treatment effects are closer to zero compared to the results in Section 5.2 and even become positive in some of the investigated fiscal years. None of the observed effects for *INF* is significant. Hypotheses H3 is thus rejected. A possible explanation for this result is the lack of options for non-aggressive tax avoidance for individuals only earning income from employment.

5.4 Determinants of Aggressive Reporting Behavior

The results obtained in Sections 5.1–5.3 indicate that the behavior regarding the *ambiguous deduction* may serve as an indicator for more or less aggressive tax reporting behavior. Therefore, the treatment variable can be used to gain insights into the directions of potential differences in characteristics between the investigated groups of taxpayers. The goal is to examine whether the hypotheses proposed in Section 3.2 hold, i.e., whether taxpayers using ambiguity differ from the control group of informed and uninformed taxpayers in terms of the investigated characteristics and thus whether those characteristics can be used as indicators for more or less tax aggressive behavior.

H2a–H2f are addressed using a logit model similar to the matching procedure in Section 5.1, thus accounting for all covariates that are assumed to affect the propensity to use the *ambiguous deduction*. *RA* is used as the binary response variable. I.e., the control group consists of both informed and uninformed taxpayers as those two groups are not assumed to differ from each other in terms of the investigated characteristics. Several adjustments to the initial logit model are made. Firstly, to obtain meaningful coefficients, sampling weights are taken into account. Secondly, the analysis focuses on taxpayers located in

the old West German states to avoid potential distortions from differences in enforcement by fiscal authorities, and thirdly, results are displayed in terms of odds ratios. The odds ratio is defined as the odds that an outcome will occur given exposure to a specific variable, divided by the odds of the outcome occurring in the absence of exposure to that variable. The odds are, in turn, defined as the probability of the outcome occurring divided by the probability of the outcome not occurring. If the odds ratio is greater than 1, exposure to the variable is associated with higher odds of the outcome occurring (i.e., the variable is identified as a risk factor for the outcome), whereas an odds ratio less than 1 indicates that exposure to the variable is associated with lower odds of the outcome occurring (i.e., the variable is protective against the outcome). For a continuous predictor, the odds ratio displays the change in odds for a one unit increase in the predictor variable. Although odds ratios are not straightforward concerning their interpretation, first insights can be gathered regarding the direction of the relationship between the covariates and the binary response *RA* and their statistical significance. In order to obtain quantitative impacts of the explanatory variables in terms of probabilities, levels of margins for different covariate values and differences in levels of margins in terms of average marginal effects (AME) are additionally calculated based on the logistic model. Results are displayed in Tables 9–11.

Table 9 Logistic regression results and marginal effects
Results of the weighted logistic regression with treatment status *RA* as the dependent variable and focus on taxpayers located in the western states of Germany. Besides odds ratios, probabilities for both values of the binary response variables and average marginal effects are displayed.

		Margins		
Variables	OR (SE) [p>|t|]	*COV* = 0 (SE)	*COV* = 1 (SE)	AME (SE) [p>|t|]
GENDER	0.7614 (0.0290) [0.0000]	0.5931 (0.0028)	0.5293 (0.0082)	−0.0638 (0.0090) [0.0000]
MWA	1.3083 (0.0496) [0.0000]	0.5694 (0.0033)	0.6305 (0.0068)	0.0611 (0.0085) [0.0000]

MWB	0.9910 (0.0905) [0.9210]	0.5843 (0.0026)	0.5822 (0.0208)	−0.0021 (0.0211) [0.9210]
MDW	1.6627 (0.0622) [0.0000]	0.5363 (0.0044)	0.6516 (0.0053)	0.1153 (0.0082) [0.0000]
AGE	0.9910 (0.0013) [0.0000]	– –	– –	−0.0021 (0.0003) [0.0000]
CHILDREN	0.9560 (0.0244) [0.0780]	0.5894 (0.0039)	0.5790 (0.0039)	−0.0104 (0.0059) [0.0780]
RELIGION	1.1634 (0.0277) [0.0000]	0.5600 (0.0046)	0.5950 (0.0031)	0.0351 (0.0055) [0.0000]
GI	0.9845 (0.0014) [0.0000]	– –	– –	−0.0030 (0.0002) [0.0000]
GI^2	1.0000 (0.0000) [0.0000]	– –	– –	– – –
MTR	0.4895 (0.2085) [0.0940]	– –	– –	−0.1647 (0.0982) [0.0930]
TC	2.1069 (0.0661) [0.0000]	0.5570 (0.0028)	0.7207 (0.0057)	0.1638 (0.0063) [0.0000]
INC_{Cap}	0.9752 (0.0525) [0.6410]	0.5845 (0.0026)	0.5787 (0.0122)	−0.0058 (0.0124) [0.6420]
INC_{Other}	1.4819 (0.1133) [0.0000]	0.5817 (0.0026)	0.6691 (0.0159)	0.0874 (0.0162) [0.0000]
DED_{House}	0.8890 (0.0827) [0.2060]	0.5846 (0.0026)	0.5573 (0.0216)	−0.0273 (0.0218) [0.2090]
DED_{Travel}	2.2378 (0.1965) [0.0000]	0.3984 (0.0198)	0.5872 (0.0026)	0.1887 (0.0200) [0.0000]
$DED_{Victuals}$	1.3465 (0.0462) [0.0000]	0.5754 (0.0028)	0.6428 (0.0070)	0.0674 (0.0076) [0.0000]

DED_{Extra}	1.5079 (0.0363) [0.0000]	0.5544 (0.0031)	0.6482 (0.0044)	0.0938 (0.0054) [0.0000]
SE_{Extra}	0.9269 (0.0610) [0.2490]	0.5847 (0.0026)	0.5671 (0.0151)	−0.0176 (0.0153) [0.2510]
EC	1.1711 (0.0330) [0.0000]	0.5768 (0.0029)	0.6130 (0.0057)	0.0362 (0.0064) [0.0000]
Cons	1.2505 (0.1828) [0.1260]	– – –	– – –	– – –
No. of obs.	50,537			
Prob > F	0.0000			
H-L Prob > F	0.2518			

To begin with, H2a is addressed, suggesting that taxpayers making use of professional tax advice have a higher propensity to use the *ambiguous deduction*. The results concerning *TC* show a significant odds ratio of approximately 2.11, indicating that taxpayers making use of a tax consultant have more than twice the odds of claiming the *ambiguous deduction* compared to self-preparing taxpayers. Column *COV* = 0 shows the average predicted probability of the response variable if every taxpayer in the data would not make use of a tax consultant, amounting to 55.7%. *COV* = 1 shows the predicted probability of *RA* if every taxpayer would make use of a tax consultant, amounting to 72.1%. The AME indicates the expected difference in probabilities for choosing the ambiguous strategy associated with a one unit increase in the level of *TC*, i.e., when the categorical variable moves from 0 to 1 while holding all the other variables at their observed values (Williams, 2012). The highly significant AME of *TC* on the probability of using the *ambiguous deduction* amounts to 0.1638, providing support for hypothesis H2a. In other words, the probability of using the *ambiguous deduction* increases by 16.38 percentage points for taxpayers making use of a tax consultant compared to the control group of taxpayers not doing so, indicating that tax consultants use ambiguities in the tax system to achieve a tax reduction for their clients as suggested by Klepper and Nagin (1989) and Klepper et al. (1991).

GENDER shows an odds ratio of 0.761, indicating that single filing female taxpayers have 0.761 times the odds of claiming the *ambiguous deduction* compared to the control group of all other individuals, i.e. single male and married taxpayers. On average, the probability for a single filing female to claim the *ambiguous deduction* amounts to 52.93%, the probability for the control group amounts to 59.31%. I.e., a significant difference of 6.38 percentage points is observable, providing support for hypothesis H2b, suggesting that females have a lower propensity to use ambiguity respectively for tax aggressiveness than other taxpayers.

In order to address H2e, three variables are used in the logistic regression model. I.e., the information whether an observation consists of two married taxpayers is further subdivided according to the income situation of the couple, i.e., whether only the husband or first-mentioned partner, only the wife or second-mentioned partner, of both spouses earn income from employment. This is done to obtain more detailed information about the influence of gender and marital status on tax aggressiveness. The three corresponding variables yield the following picture: If only the male or first-mentioned partner (*MWA* = 1) or both partners (*MDW* = 1) earn income from employment, an increase in the odds for tax aggressiveness is observable and the AMEs show a significant increase in the probability to use the *ambiguous deduction* amounting to 6.11, respectively 11.53 percentage points. No significant odds ratio and AME is observable if only the female or second-mentioned partner earns income from employment. For most of the observations representing a couple of married taxpayers, taxpayer A is male and taxpayer B is female. If *MWA* = 1 or *MDW* = 1, the male taxpayer is assumed to be at least co-responsible for filing the tax return for deductions related to employment income. If *MWB* = 1, the female taxpayer is assumed to be responsible. It is concluded that these results provide further support for hypothesis H2b, indicating that male taxpayers have a higher propensity to exploit ambiguity than females, also in the course of a marriage. Concerning H2e, married taxpayers are more inclined to use the *ambiguous deduction* compared to other taxpayers only if at least the male or first-mentioned partner is responsible for filing for income-related deductions. But the results also indicate that aggressiveness is most

likely to occur in case of married taxpayers with both spouses earning income from employment.

The last binary variable, *RELIGION*, has been assumed to negatively influence the propensity for reporting aggressiveness. The corresponding odds ratio does not provide support for this hypothesis, as the odds of claiming the *ambiguous deduction* are significant and 1.1634 times higher for taxpayers paying church tax than for taxpayers not doing so. The AME indicates that church members have a probability of claiming the *ambiguous deduction* that is increased by 3.51 percentage points compared to nonreligious taxpayers. H2f is thus rejected.

The odds ratio of the continuous variable *AGE* amounts to 0.991, indicating that every unit increase in *AGE* decreases the odds of using the *ambiguous deduction*, pointing to the predicted direction. The corresponding significant AME amounting to −0.0021 indicates that the probability to claim the *ambiguous deduction* decreases by 0.21 percentage points for every additional year in age of the corresponding taxpayer. To gain further insights into the relationship between *AGE* and *RA*, levels of margins for different covariate values are calculated and displayed in Table 10. The results indicate a continuous decrease in the propensity to use ambiguity between the age of 20 and 70 years. The results thus support hypothesis H2c, suggesting that younger taxpayers are more tax aggressive.

Table 10 Levels of margins for representative values of *AGE*

AGE	Margin	StE	p>|t|	95% CI	
20	0.6306	0.0069	0.0000	0.6170	0.6442
30	0.6104	0.0045	0.0000	0.6016	0.6192
40	0.5898	0.0027	0.0000	0.5846	0.5951
50	0.5690	0.0034	0.0000	0.5623	0.5756
60	0.5479	0.0058	0.0000	0.5364	0.5593
70	0.5266	0.0087	0.0000	0.5096	0.5437

Finally, concerning the income level, the odds ratios indicate a negative relationship between gross earnings and the probability to claim the *ambiguous deduction*, as the significant odds ratio for *GI* amounts to 0.9845. The significant AME amounting to −0.003 suggests that the probability for aggressive behavior decreases by 0.3 percentage points

for every additional thousands of euros. The results thus do not provide support for the assumption that a higher income class is associated with more aggressive reporting behavior. Again, to gain further insights into the relationship between *GI* and *RA*, levels of margins for different covariate values are calculated and displayed in Table 11.

Table 11 Levels of margins for representative values of *GI* in TEUR

GI	Margin	StE	p>|t|	95% CI	
20	0.6633	0.0065	0.0000	0.6505	0.6760
40	0.6015	0.0028	0.0000	0.5960	0.6070
60	0.5416	0.0044	0.0000	0.5330	0.5502
80	0.4857	0.0079	0.0000	0.4703	0.5012
100	0.4353	0.0107	0.0000	0.4143	0.4563
120	0.3910	0.0127	0.0000	0.3661	0.4159

The results show a continuous decrease in the probability to use the *ambiguous deduction*. H2d is thus rejected with respect to the expected positive relationship between income and aggressiveness. By contrast, the results point to the first component of hypothesis H2d, suggesting that financial distress might encourage aggressive reporting behavior. But also for higher income classes, a negative relationship with aggressiveness in the sense of using ambiguity is observable, suggesting that aggressiveness decreases with increasing income.

6 Summary and Concluding Remarks

This study investigates whether taxpayers' reaction to a case of ambiguity in the German tax system can serve as an indicator for more or less aggressive overall reporting behavior. A definition is proposed suggesting that taxpayers behave aggressively when dealing with ambiguity in an exploitative manner. Thereby, aggressiveness is assumed to be a gradual concept, meaning that taxpayers are considered more aggressive when using reporting options with higher probabilities of rejection. Differences concerning the use of ambiguity are thus, on the one hand, traced back to differing rejection probabilities of uncertain tax positions. On the other hand, when focusing on a specific ambiguous position, differing reactions are attributed to differences in taxpayers' intrinsic motivation to comply. I.e., taxpayers are assumed to

incur a certain level of psychic costs when deviating from the social norm of non-aggressive tax compliance. The individual rate of psychic costs encourages or discourages them to choose a specific option. It is concluded that taxpayers have an individual cut-off value of rejection probability, which is higher for taxpayers with lower psychic costs. Taxpayers using a specific option have a higher cut-off value than taxpayers not using it and are thus assumed to also choose other ambiguous options that taxpayers in the control group refrain from using. Consequently, they are hypothesized to arrive at a lower tax burden.

A well-known ambiguity in the German income tax system is used to test the practical suitability of these theoretical considerations. The analysis indicates that taxpayers exploiting ambiguity arrive at a significantly lower effective average tax rate than the control group of taxpayers not doing so. In other words, taxpayers behaving more aggressively in the process-oriented sense outlined above can be considered more aggressive in an outcome-oriented sense, i.e. they arrive at a lower tax burden. The empirical investigation provides stable results, holding for different fiscal years and when controlling for potential confounders such as differences in non-aggressive tax avoidance and state differences in tax enforcement. The results thus indicate the usefulness of the developed definition of tax aggressiveness and the chosen approach to distinguish between more and less aggressive taxpayers.

Several limitations must be taken into account when interpreting the results. Firstly, potential alternative explanations for differences in behavior cannot be ruled out. Besides moral costs, differences in risk attitude could also cause differences concerning the use of ambiguity. I.e., taxpayers not exploiting ambiguity might have a higher level of risk aversion influencing their behavior despite the fact that a fine is not to be expected. Besides uncertainty concerning the legal assessment of an ambiguous item, there is also uncertainty concerning future reactions by the fiscal authority in case of an audit and rejection of an ambiguous item. As tax authorities' goal is precisely to remain unpredictable, taxpayers may fear that authorities decide to prohibit the approach, thus remove ambiguity without the taxpayer taking note of it and start to impose a fine from one year to the next. Furthermore, taxpayers might anticipate negative consequences in terms of a

negative judgement by fiscal authorities of themselves as a compliant person. In other words, they might fear to attract auditors' attention by using ambiguity.

Secondly, just as aggressiveness is defined as a gradual concept, it is crucial to also interpret the results as a gradual manifestation of tax aggressiveness. I.e., it cannot be inferred that taxpayers claiming the *ambiguous deduction* are aggressive and taxpayers not claiming it are unaggressive. The former should rather be considered *more* aggressive. Still, the observed difference and the possibility to identify two groups of taxpayers allows to gain further insides into reporting behavior and could assist fiscal authorities to enhance rules for strategic audits. Dividing taxpayers into a group of aggressive and a group of unaggressive taxpayers could be achieved by setting a threshold of rejection probability and investigating taxpayers' reactions concerning a corresponding ambiguous item. But, the rejection probability is assumed to be subject to taxpayers' perception and is thus unknown. In this context, it must also be noted that taxpayers might have non-uniform perceptions of the rejection probability of a specific ambiguous item and that the interaction between psychic costs and rejection probability is more complex than stated in the model.

Finally, and despite the robustness check performed in Section 5.3, it remains unknown, whether the data has been changed in the course of an audit. I.e., it is possible that taxpayers claimed the *ambiguous deduction*, but tax authorities chose to disallow it. Specifically, the results might be misleading if the *ambiguous deduction* and a variety of other items have been audited and changed, leading to a substantial increase in the ETR. In this case, the observed control group is in fact the group of audited taxpayers and the results can only lead to the conclusion that audited taxpayers arrive at higher ETR than unaudited taxpayers. But, as real audit probabilities specifically for wage-earning taxpayers are assumed to be low, this drawback is not assumed to lead to a substantial bias in the results.

Pointing to future research, the results may be used to further investigate compliance behavior of taxpayers depending on group membership. For instance, their behavior concerning other ambiguities can be tested. This can provide further insights into the applicability of the model by testing whether taxpayers show consistent behavior, i.e.,

whether assumingly more ambiguous options are used by taxpayers using the *ambiguous deduction* but not by taxpayers not using it. Additionally, it could be tested whether taxpayers exploiting ambiguity are more inclined to use evasive options. Finally, future research should empirically investigate developments over time concerning the spread of tax aggressive behavior amongst taxpayers and its determinants. Paetzold and Winner (2016), e.g., use job changes to examine the effect of changes in taxpayers' personal environment on compliance behavior. They find evidence for the existence of spillover effects in the sense that taxpayers are influenced by compliance behavior of taxpayers in their vicinity. This approach could be used to, e.g., investigate whether changes of residence lead to changes in compliance behavior as a consequence of the new environment which potentially consists of more or less aggressive taxpayers.

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Appendix A

Table A.1 Logistic regression results
The table displays the results of the unweighted logistic regression with treatment status *RA* as the dependent variable.

Variables	Coeff.	SE	p>|z|
GENDER	−0.3121	0.0345	0.000
MWA	0.1971	0.0324	0.000
MWB	−0.1233	0.0753	0.101
MDW	0.3279	0.0304	0.000
ORIGIN	−0.9004	0.0275	0.000
AGE	−0.0085	0.0011	0.000
CHILDREN	−0.0528	0.0197	0.007
RELIGION	0.0989	0.0190	0.000
GI	−0.0023	0.0006	0.000
GI^2	0.0000	0.0000	0.015
MTR	−3.0969	0.2721	0.000
TC	0.7514	0.0232	0.000
INC_{Cap}	−0.0581	0.0340	0.088
INC_{Other}	0.2964	0.0594	0.000
DED_{House}	0.0206	0.0499	0.680
DED_{Travel}	0.7212	0.0621	0.000
$DED_{Victuals}$	0.2761	0.0271	0.000
DED_{Extra}	0.2830	0.0187	0.000
SE_{Extra}	0.0357	0.0465	0.443
EC	0.1194	0.0218	0.000
SW	0.0077	0.0009	0.000
CONS	0.4010	0.1116	0.000
Pseudo-R^2	0.0538		
No. of obs.	59,619		

Table A.2 Matching quality

	Pseudo-R^2	Mean bias
Before Matching	0.054	0.100
After Matching	0.000	0.006

Table A.3 Logistic regression results

The table displays the results of the unweighted logistic regressions with (1) treatment status RA_{corr} and (2) treatment status *INF* as the dependent variables.

Treatment		RA_{corr}			*INF*	
Variables	Coeff.	SE	p>|z|	Coeff.	SE	p>|z|
GENDER	-0.3870	0.0384	0.000	0.1979	0.0512	0.000
MWA	0.1553	0.0360	0.000	0.1087	0.0498	0.029
MWB	-0.1717	0.0835	0.040	0.1090	0.1136	0.337
MDW	0.2522	0.0335	0.000	0.2562	0.0459	0.000
ORIGIN	-1.0030	0.0293	0.000	0.3697	0.0386	0.000
AGE	-0.0047	0.0012	0.000	-0.0130	0.0017	0.000
CHILDREN	-0.0424	0.0215	0.049	-0.0441	0.0305	0.149
RELIGION	0.1057	0.0210	0.000	-0.0233	0.0287	0.417
GI	-0.0020	0.0007	0.004	-0.0024	0.0007	0.000
GI^2	0.0000	0.0000	0.013	0.0000	0.0000	0.204
MTR	-3.4682	0.3014	0.000	1.3488	0.3739	0.000
TC	0.5468	0.0249	0.000	0.8217	0.0451	0.000
INC_{Cap}	-0.1400	0.0365	0.000	0.2769	0.0501	0.000
INC_{Other}	0.2468	0.0655	0.000	0.1775	0.0977	0.069
DED_{House}	-0.0180	0.0540	0.738	0.1875	0.0704	0.008
DED_{Travel}	0.3641	0.0723	0.000	0.9674	0.0740	0.000
$DED_{Victuals}$	0.1786	0.0296	0.000	0.3619	0.0465	0.000
DED_{Extra}	0.1299	0.0204	0.000	0.5501	0.0312	0.000
SE_{Extra}	0.0210	0.0508	0.679	0.0421	0.0707	0.552
EC	0.0908	0.0239	0.000	0.1017	0.0347	0.003
SW	0.0071	0.0010	0.000	0.0016	0.0012	0.172
CONS	1.2461	0.1268	0.000	-0.4643	0.1576	0.003
Pseudo-R^2	0.0538					
No. of obs.	59,619					

Table A.4 Distribution of *RA* in the different federal states of Germany
The table displays the proportions of taxpayers claiming the *ambiguous deduction* depending on the federal states for the fiscal years 2005 to 2010.

Variables		2005	2006	2007	2008	2009	2010
Total (throughout Germany)		0.5482	0.5337	0.5334	0.5204	0.5509	0.5480
Former West German states		0.5842	0.5698	0.5672	0.5553	0.5853	0.5770
	SH	0.0615	0.0954	0.2563	0.2608	0.3003	0.3438
	HH	0.5661	0.5563	0.5251	0.5201	0.5665	0.6031
	ND	0.5622	0.5488	0.5337	0.5142	0.5323	0.4494
	HB	0.6374	0.6595	0.6251	0.6184	0.6585	0.6348
	NW	0.6096	0.5916	0.5837	0.5757	0.6016	0.6031
	HE	0.6928	0.6704	0.6351	0.618	0.6516	0.6527
	RP	0.6238	0.5991	0.6061	0.5776	0.6244	0.6333
	BW	0.6074	0.5893	0.5601	0.5533	0.5729	0.5733
	BY	0.6419	0.6283	0.6103	0.6004	0.6339	0.6297
	SL	0.6673	0.6218	0.6462	0.6162	0.6594	0.6585
Newlyformed German states		0.3688	0.3658	0.3723	0.3656	0.4003	0.4221
	B	0.3073	0.3247	0.3452	0.328	0.3438	0.3771
	BB	0.2897	0.2796	0.3076	0.3009	0.3279	0.3644
	MV	0.5061	0.5367	0.5212	0.4817	0.5362	0.5151
	SN	0.3222	0.3001	0.313	0.3187	0.3484	0.3792
	ST	0.4515	0.4536	0.4299	0.4461	0.489	0.5092
	TH	0.3966	0.3731	0.3881	0.3763	0.4088	0.4272

SH = Schleswig-Holstein, *HH* = Hamburg, *ND* = Lower Saxony, *HB* = Bremen, *NW* = North Rhine-Westphalia, *HE* = Hesse, *RP* = Rhineland-Palatinate, *BW* = Baden-Württemberg, *BY* = Bavaria, *SL* = Saarland, *B* = Berlin, *BB* = Brandenburg, *MV* = Mecklenburg-Vorpommern, *SN* = Saxony, *ST* = Saxony-Anhalt, *TH* = Thuringia

Appendix B

Table B.1 Construction of the sub-sample (2006–2010)

	2006	2007	2008	2009	2010
5% TPP	727,368	727,368	727,368	727,368	727,368
TP without employment income	190,141	195,370	200,776	208,099	215,384
TP with business Income	339,472	337,784	335,102	330,589	327,848
TP with income below the basic tax-free amount	2,755	2,166	1,855	2,353	2,309
Sub-sample	195,000	192,048	189,635	186,327	181,827
TP claiming *IRD* below *SD*	80,605	78,853	77,178	78,104	76,137
TP claiming *AD* above the lump sums	58,900	59,162	58,097	58,877	56,560
Final sub-sample	55,495	54,033	54,360	49,346	49,130

Table B.2 Descriptive statistics (weighted sample) (2006–2010)

	2006	2007	2008	2009	2010
Variable	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
RA	0.5337 (0.3656)	0.5334 (0.3692)	0.5204 (0.3684)	0.5509 (0.3667)	0.5480 (0.3662)
ETR	0.1231 (0.0461)	0.1279 (0.0456)	0.1299 (0.0467)	0.1260 (0.0472)	0.1189 (0.0446)
ETR_{corr}	0.1236 (0.0461)	0.1285 (0.0456)	0.1304 (0.0467)	0.1266 (0.0472)	0.1194 (0.0446)
GENDER	0.1377 (0.2526)	0.1422 (0.2585)	0.1432 (0.2583)	0.1442 (0.2590)	0.1500 (0.2627)
MWA	0.2076 (0.2973)	0.1958 (0.2937)	0.1892 (0.2888)	0.1833 (0.2853)	0.1738 (0.2788)
MWB	0.0236 (0.1112)	0.0222 (0.1089)	0.0249 (0.1150)	0.0270 (0.1196)	0.0281 (0.1215)
MDW	0.4336 (0.3632)	0.4451 (0.3678)	0.4449 (0.3665)	0.4540 (0.3671)	0.4513 (0.3661)

ORIGIN	0.1770	0.1734	0.1840	0.1859	0.1872
	(0.2797)	(0.2802)	(0.2857)	(0.2869)	(0.2870)
AGE	43.8099	44.5895	45.3802	46.2302	46.7616
	(7.0517)	(7.0051)	(6.9584)	(6.8421)	(6.7745)
CHILDREN	0.5051	0.4967	0.4823	0.4695	0.4581
	(0.3664)	(0.3701)	(0.3685)	(0.3680)	(0.3666)
RELIGION	0.5945	0.6068	0.6064	0.6136	0.6046
	(0.3599)	(0.3615)	(0.3603)	(0.3590)	(0.3597)
GI	46.6004	48.5681	49.8843	50.0541	51.4084
	(18.2276)	(19.9626)	(20.6176)	(20.8810)	(20.9456)
GI^2	2790.11	3086.34	3270.16	3307.52	3453.25
	(8620.68)	(41754.62)	(9901.23)	(50362.18)	(6956.47)
MTR	0.3619	0.3665	0.3680	0.3669	0.3682
	(0.0411)	(0.0400)	(0.0404)	(0.0410)	(0.0411)
INC_{Cap}	0.0419	0.0931	0.1079	0.0704	0.0684
	(0.1469)	(0.2150)	(0.2288)	(0.1886)	(0.1858)
INC_{Other}	0.0369	0.0399	0.0464	0.0535	0.0575
	(0.1382)	(0.1448)	(0.1551)	(0.1659)	(0.1712)
DED_{House}	0.0197	0.0190	0.0181	0.0179	0.0185
	(0.1019)	(0.1010)	(0.0984)	(0.0977)	(0.0992)
DED_{Travel}	0.9812	0.9823	0.9795	0.9792	0.9767
	(0.0995)	(0.0975)	(0.1046)	(0.1053)	(0.1109)
$DED_{Victuals}$	0.1532	0.1387	0.1480	0.1484	0.1458
	(0.2640)	(0.2558)	(0.2619)	(0.2621)	(0.2596)
DED_{Extra}	0.3446	0.3563	0.3612	0.3664	0.3626
	(0.3483)	(0.3545)	(0.3542)	(0.3552)	(0.3537)
SE_{Extra}	0.0295	0.0306	0.0317	0.0311	0.0307
	(0.1240)	(0.1275)	(0.1291)	(0.1279)	(0.1270)
EC	0.1995	0.2008	0.2052	0.2182	0.2181
	(0.2929)	(0.2965)	(0.2978)	(0.3045)	(0.3039)

Table B.3 Logistic regression results (2006–2010)
The table displays the results of the unweighted logistic regressions with treatment status *RA* as the dependent variables for the fiscal years 2006–2010.

	2006	2007	2008	2009	2010
Variables	Coeff. (SE) [p]	Coeff. (SE) [p]	Coeff. (SE) [p]	Coeff. (SE) [p]	Coeff. (SE) [p]
GENDER	−0.3041	−0.3221	−0.3276	−0.3722	−0.3496
	(0.0352)	(0.0356)	(0.0351)	(0.0369)	(0.036)
	[0]	[0]	[0]	[0]	[0]
MWA	0.2111	0.1836	0.1985	0.1920	0.2062
	(0.0333)	(0.034)	(0.0335)	(0.0354)	(0.0352)
	[0]	[0]	[0]	[0]	[0]
MWB	−0.1548	−0.1522	−0.0205	−0.0336	−0.0485
	(0.0754)	(0.0783)	(0.0737)	(0.0745)	(0.0718)
	[0.04]	[0.052]	[0.781]	[0.652]	[0.499]
MDW	0.3975	0.3508	0.3467	0.3718	0.3153
	(0.0312)	(0.0314)	(0.0309)	(0.0323)	(0.0317)
	[0]	[0]	[0]	[0]	[0]
ORIGIN	−0.9047	−0.8311	−0.8349	−0.7913	−0.6613
	(0.0276)	(0.028)	(0.0273)	(0.028)	(0.0275)
	[0]	[0]	[0]	[0]	[0]
AGE	−0.0097	−0.0092	−0.0101	−0.0161	−0.0146
	(0.0011)	(0.0011)	(0.0012)	(0.0012)	(0.0012)
	[0]	[0]	[0]	[0]	[0]
CHILDREN	−0.0599	−0.0501	−0.0418	−0.0267	−0.0366
	(0.0201)	(0.0203)	(0.0202)	(0.0211)	(0.021)
	[0.003]	[0.014]	[0.039]	[0.205]	0.0000
RELIGION	0.0671	0.0917	0.0366	0.0553	0.0612
	(0.0194)	(0.0196)	(0.0196)	(0.0205)	(0.0204)
	[0.001]	[0]	[0.061]	[0.007]	0.0000
GI	−0.0013	−0.0014	−0.0002	−0.0023	−0.0019
	(0.0004)	(0.0004)	(0.0005)	(0.0006)	(0.0006)
	[0.003]	[0.001]	[0.722]	[0]	0.0000
GI^2	0.0000	0.0000	0.0000	0.0000	0.0000
	(0)	(0)	(0)	(0)	(0)
	[0.054]	[0.001]	[0.366]	[0.004]	0.0000
MTR	−3.1508	−2.8600	−3.3553	−2.5916	−2.3797
	(0.2549)	(0.2724)	(0.2719)	(0.2914)	(0.2811)
	[0]	[0]	[0]	[0]	0.0000

INC_{Cap}	−0.0423	−0.0378	−0.0259	−0.0272	0.0229
	(0.034)	(0.0261)	(0.0251)	(0.0308)	(0.0303)
	[0.214]	[0.148]	[0.304]	[0.376]	0.0000
INC_{Other}	0.3285	0.1939	0.2061	0.2505	0.2739
	(0.058)	(0.0556)	(0.0508)	(0.0501)	(0.0475)
	[0]	[0]	[0]	[0]	0.0000
DED_{House}	−0.0871	−0.1057	−0.1037	−0.1162	−0.0842
	(0.0526)	(0.0537)	(0.0525)	(0.0537)	(0.0524)
	[0.098]	[0.049]	[0.048]	[0.031]	0.0000
DED_{Travel}	0.6409	0.5237	0.4094	0.3178	0.3781
	(0.065)	(0.0698)	(0.064)	(0.0655)	(0.0607)
	[0]	[0]	[0]	[0]	0.0000
$DED_{Victuals}$	0.2325	0.3159	0.2429	0.2454	0.2647
	(0.0274)	(0.0293)	(0.0273)	(0.0285)	(0.0285)
	[0]	[0]	[0]	[0]	0.0000
DED_{Extra}	0.2454	0.1816	0.1749	0.1112	0.1617
	(0.0187)	(0.0188)	(0.0187)	(0.0195)	(0.0195)
	[0]	[0]	[0]	[0]	0.0000
SE_{Extra}	−0.0227	−0.0303	0.0174	0.0328	0.0167
	(0.0468)	(0.0463)	(0.0451)	(0.0475)	(0.047)
	[0.627]	[0.512]	[0.7]	[0.49]	0.0000
EC	0.2018	0.1762	0.1672	0.1610	0.1630
	(0.0232)	(0.0234)	(0.023)	(0.0236)	(0.0234)
	[0]	[0]	[0]	[0]	0.0000
SW	0.0090	0.0092	0.0118	0.0070	0.0067
	(0.0008)	(0.0009)	(0.0009)	(0.001)	(0.0009)
	[0]	[0]	[0]	[0]	[0]
$Cons$	0.5055	0.5217	0.6739	1.2128	0.9805
	(0.1154)	(0.1221)	(0.1182)	(0.1244)	(0.122)
	[0]	[0]	[0]	[0]	0.0000
Pseudo-R^2	0.0412	0.0392	0.0380	0.0365	0.0299
No. of obs.	55,495	54,033	54,360	49,346	49,130

Table B.4 Matching quality (2006–2010)

		Pseudo-R^2	Mean bias
2006	Before matching	0.044	0.097
	After matching	0.003	0.013
2007	Before matching	0.039	0.093
	After matching	0.000	0.006
2008	Before matching	0.038	0.093
	After matching	0.000	0.005
2009	Before matching	0.036	0.085
	After matching	0.000	0.007
2010	Before matching	0.030	0.083
	After matching	0.000	0.006

Table B.5 Average treatment effect (2006–2010)
The table displays the average treatment effects of treatment variable *RA* on the levels of *ETR* and ETR_{corr} for the fiscal years 2006–2010.

	Mean	Treated	Un-treated	Δ	SE	p>t
2006						
ETR	0.123067	0.118449	0.128353	−0.009904	0.000594	0.0000
ETR_{corr}	0.123611	0.119273	0.128575	−0.009302	0.000594	0.0000
2007						
ETR	0.127916	0.122904	0.133645	−0.010741	0.000593	0.0000
ETR_{corr}	0.128459	0.123734	0.133860	−0.010126	0.000593	0.0000
2008						
ETR	0.129891	0.124334	0.135919	−0.011584	0.000604	0.0000
ETR_{corr}	0.130418	0.125147	0.136135	−0.010988	0.000604	0.0000
2009						
ETR	0.126046	0.120274	0.133126	−0.012852	0.000645	0.0000
ETR_{corr}	0.126576	0.121067	0.133335	−0.012267	0.000645	0.0000
2010						
ETR	0.118938	0.114151	0.124740	−0.010589	0.000610	0.0000
ETR_{corr}	0.119451	0.114920	0.124944	−0.010025	0.000610	0.0000

Table B.6 Average treatment effects (2006–2010)
The table presents the average treatment effects of treatment variable RA_{corr} and treatment variable *INF* on the levels of the *ETR* and ETR_{corr} for the fiscal years 2006–2010.

	Mean	Treated	Un-treated	Δ	SE	p>t
RA_{corr}						
2006						
ETR	0.122115	0.118470	0.127992	−0.009522	0.000651	0.0000
ETR_{corr}	0.122744	0.119295	0.128306	−0.009011	0.000651	0.0000
2007						
ETR	0.126630	0.122903	0.132886	−0.009983	0.000656	0.0000
ETR_{corr}	0.127269	0.123733	0.133202	−0.009469	0.000655	0.0000
2008						
ETR	0.128349	0.124308	0.134567	−0.010259	0.000664	0.0000
ETR_{corr}	0.128961	0.125120	0.134873	−0.009753	0.000663	0.0000
2009						
ETR	0.124620	0.120272	0.132298	−0.012027	0.000716	0.0000
ETR_{corr}	0.125235	0.121065	0.132598	−0.011533	0.000716	0.0000
2010						
ETR	0.117685	0.114171	0.123771	−0.009600	0.000674	0.0000
ETR_{corr}	0.118279	0.114939	0.124062	−0.009123	0.000673	0.0000
INF						
2006						
ETR	0.128346	0.127983	0.129232	−0.001249	0.001008	0.2150
ETR_{corr}	0.128569	0.128297	0.129233	−0.000936	0.001008	0.3530
2007						
ETR	0.133650	0.132894	0.135265	−0.002371	0.000979	0.0150
ETR_{corr}	0.133866	0.133210	0.135266	−0.002056	0.000979	0.0360
2008						
ETR	0.135950	0.134610	0.139148	−0.004538	0.001000	0.0000
ETR_{corr}	0.136166	0.134916	0.139149	−0.004233	0.001000	0.0000
2009						
ETR	0.133170	0.132361	0.135009	−0.002649	0.001081	0.0140
ETR_{corr}	0.133379	0.132661	0.135010	−0.002349	0.001081	0.0300
2010						
ETR	0.124758	0.123794	0.126999	−0.003205	0.001036	0.0020
ETR_{corr}	0.124962	0.124085	0.126999	−0.002914	0.001036	0.0050

Table B.7 Average treatment effects (2006–2010)
The table presents the average treatment effects of treatment variable RA_{corr} and treatment variable *INF* on the levels of the *ETR* and ETR_{corr} for the fiscal years 2006–2010 focusing on taxpayers located in the western states of Germany.

	Mean	Treated	Untreated	Δ	SE	p>t
RA_{corr}						
2006						
ETR	0.127146	0.122180	0.136725	−0.014544	0.000711	0.0000
ETR_{corr}	0.127800	0.123007	0.137046	−0.014039	0.000710	0.0000
2007						
ETR	0.131061	0.126149	0.140827	−0.014678	0.000718	0.0000
ETR_{corr}	0.131720	0.126977	0.141151	−0.014173	0.000717	0.0000
2008						
ETR	0.133500	0.127819	0.143899	−0.016081	0.000720	0.0000
ETR_{corr}	0.134135	0.128631	0.144210	−0.015579	0.000720	0.0000
2009						
ETR	0.129397	0.123595	0.141641	−0.018047	0.000785	0.0000
ETR_{corr}	0.130034	0.124388	0.141948	−0.017560	0.000784	0.0000
2010						
ETR	0.122187	0.117451	0.131728	−0.014277	0.000737	0.0000
ETR_{corr}	0.122798	0.118219	0.132022	−0.013803	0.000737	0.0000
INF						
2006						
ETR	0.136171	0.136720	0.134972	0.001748	0.001089	0.1080
ETR_{corr}	0.136392	0.137042	0.134973	0.002069	0.001089	0.0570
2007						
ETR	0.140845	0.140874	0.140791	0.000083	0.001063	0.9380
ETR_{corr}	0.141059	0.141198	0.140791	0.000406	0.001063	0.7020
2008						
ETR	0.144344	0.143911	0.145271	−0.001360	0.001071	0.2040
ETR_{corr}	0.144556	0.144221	0.145272	−0.001051	0.001071	0.3270
2009						
ETR	0.141261	0.141613	0.140553	0.001060	0.001169	0.3640
ETR_{corr}	0.141467	0.141920	0.140554	0.001366	0.001169	0.2420
2010						
ETR	0.131917	0.131714	0.132339	−0.000625	0.001118	0.5760
ETR_{corr}	0.132116	0.132008	0.132340	−0.000332	0.001118	0.7660

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