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Multidimensional Tax Compliance Attitude

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School of Business & Economics
Discussion Paper

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Multidimensional Tax Compliance Attitude^{ab}

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Abstract

Citizen tax compliance significantly dictates governmental fiscal capacities. Recognizing this, understanding the determinants of tax compliance remains paramount. While existing literature frequently isolates and tests individual determinants such as audit likelihood, penalty structures, tax morale, and perceived fairness, an integrative, bottom-up approach addressing the spectrum of tax compliance attitudes has largely been overlooked. Addressing this gap, our study constructs a multidimensional Tax Compliance Attitude Inventory (TCAI) by harmonizing real taxpayer responses with established theoretical underpinnings. Through factor analysis, we delineate four pivotal factors: (i) morale, (ii) monetary benefit, (iii) deterrence, and (iv) authority. Notably, morale and deterrence emerge as consistent influencers of tax compliance. Embracing this multidimensionality, our cluster analysis demarcates two distinct taxpayer personas: (a) moralists and (b) rationalists. Our findings underscore that moralists consistently exhibit higher tax compliance than their rationalist counterparts. We further present a streamlined classification algorithm to operationalize the TCAI in new datasets, minimizing item count. This work serves as a seminal contribution, offering both academia and tax authorities a robust, quantitative tool to gauge tax compliance attitudes.

Keywords

Behavioral economics, compliance attitudes, compliance behavior, tax evasion, heterogeneous individuals

JEL-Classification

C38, C83, D91, H26

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1 Introduction

Tax compliance is intricately tied to the obligation of tax payments. In a majority of countries, individuals are required to file tax returns to ascertain their tax obligations. A critical question then emerges: on what basis do individuals decide to comply or not? An understanding of the motivations underpinning tax compliance decisions is essential. Such insights enable governments and tax authorities to more effectively promote compliant behavior. This understanding is crucial because each act of non-compliance diminishes tax revenues, subsequently constraining the national budget.

The landscape of tax compliance research has evolved since the foundational model proposed by Allingham & Sandmo (1972). Beyond factors such as penalty systems, audit probabilities, and tax rates, other determinants have been recognized as influencing tax compliance. Notably, the perceived fairness of the tax system and individual tax morale have been identified as significant contributors (Spicer & Becker, 1980; Torgler, 2003). Also, trust in the authorities is shown to be positively linked to tax compliance (Kirchler et al., 2008; Scholz & Pinney, 1995). Over the years, an extensive amount of literature has developed around the motivations to pay taxes (Alm, 2019; Andreoni et al., 1998).

Historically, research in this domain has predominantly been theory-driven (see, for example, Beck et al., 1991; Wahl et al., 2010). Driving forces like tax morale were hypothesized and tested afterwards. However, this top-down approach has two potential pitfalls: (1) it risks overlooking crucial factors, and (2) as an increasing number of driving forces are identified, a comprehensive approach becomes imperative for the practical application of results and for informing future research. In this study, we adopt a bottom-up approach. We initiate our research with an online survey targeting real taxpayers ($N = 201$), querying them about their considerations during tax compliance decisions. Responses suggest that tax compliance attitudes are multifaceted. By integrating these responses with driving forces identified in prior literature, we formulated a

comprehensive set of 104 items. In a subsequent online survey involving a different set of real taxpayers ($N = 303$), these items were rated based on their perceived importance in tax compliance decisions. A factor analysis reveals that this multifaceted nature could be distilled into four distinct factors. Drawing from the item descriptions, we labeled these as: (i) *morale*, (ii) *monetary benefit*, (iii) *deterrence*, and (iv) *authority*. From this, we crafted a 16-item questionnaire, termed the *Tax Compliance Attitude Inventory (TCAI)*.

Of note, our findings particularly highlight the influence of the morale and deterrence factors on tax compliance, as evidenced in a third large-scale online survey involving real taxpayers ($N = 2,825$). The roles of monetary benefit and authority yield mixed results, with some measures registering significant findings and others not. These conclusions remain consistent even when applied to an incentivized context, as demonstrated in another incentivized online experiment with real taxpayers ($N = 334$). The data also hints at substantial heterogeneity, prompting us to execute a cluster analysis across the four factors. Two predominant taxpayer clusters emerged: (a) *moralists* and (b) *rationalists*. This typological approach enables a nuanced understanding of individual tax compliance behaviors, with moralists displaying a significantly stronger propensity towards compliance compared to rationalists.

Subsequently, we managed to refine the *TCAI*, reducing its items to either twelve or an optional four. We also introduce a simplified classification algorithm to consistently identify the moralist and rationalist clusters in new sample sets using any version of our *TCAI*. Leveraging the experimental data, we further validate the external applicability of our findings.

This article offers several key contributions to the existing body of research. Firstly, it provides a structured overview of literature concerning tax compliance attitudes. Secondly, it introduces a multidimensional metric to gauge tax compliance attitudes. Thirdly, our typological differentiation uniquely leverages quantitative methodologies, distinguishing our work from prior research

in taxpayer typology such as Torgler (2003) and Vogel (1974). Fourthly, we demonstrate that taxpayer typologies can serve as a predictive tool for tax evasion.

The structure of this article is as follows: In Section 2, we elucidate the related literature and discuss the results of the factor analysis. Section 3 delves into the interrelationships of the factors with tax compliance. Subsequently, Section 4 presents the cluster analysis. Section 5 investigates the variations in tax compliance behaviors between the identified clusters, evaluates different compositions of the *TCAI*, and introduces the classification algorithm. Finally, Section 6 provides the discussion and conclusion of the article.

2 Derivation of the questionnaire

2.1 Related literature

The field of crime is a well-researched topic in literature. Becker's (1968) seminal work introduced the economics of crime model, highlighting the audit probability and penalty system as primary drivers of compliant behavior. Subsequently, Allingham & Sandmo (1972) refined Becker's model applying it a tax evasion framework, laying the groundwork for extensive research into the nuances of tax compliance motivations. Historically, much of the focus rested in the beginning on the neoclassical model of human decision-making, viewing individuals as rational utility maximizers. However, advances in behavioral taxation challenge this perspective by accommodating a more realistic view on the decision-making structure. Over the years, this has led to the identification of a plethora of variables influencing tax compliance. The Classic work by Allingham & Sandmo (1972) and later Beck et al. (1991) suggest that audit probabilities and penalty systems significantly influence compliance. Yet, perceptions of these variables also matter. Notably, Alm et al. (1992) demonstrated that participants tend to overestimate audit probabilities, a finding corroborated by other studies (Kirchler, 2007; Scholz & Pinney, 1995). Additionally, individual risk attitudes, complexities in the tax system, and (un)awareness of potential penalties all factor into

tax compliance (Kirchler, 2007; Alm, 2019; Andreoni et al., 1998; Hofmann et al., 2017). On the other hand, in line with rational decision-making Gordon (1989) and Friedland et al. (1978) show a negative relation between tax rate and tax compliance behavior. The higher the tax obligation the less attractive is the compliance choice.

Beyond individual behavior, the reciprocal relationship between taxpayers and the government plays a crucial role in tax compliance. For many, tax payment is not merely an obligation but a price for benefits like infrastructure and social security. Bordignon (1993) emphasized the value citizens place on this exchange relationship. Trust in authorities is paramount; a sentiment echoed in Kirchler et al.'s (2008) *slippery slope model*, which differentiates between enforced and voluntary tax compliance. A wealth of literature underscores the positive correlation between trust in government and tax compliance (Kastlunger et al., 2013; Torgler, 2003; Torgler & Schneider, 2005; Wahl et al., 2010). Feld and Frey (2002) termed this relationship as a 'psychological contract'.

Also, the way how fairly taxes are collected and spent influences tax compliance. Alm et al. (1993) show higher tax compliance when taxpayers support the tax usage. Spicer & Becker (1980) show decreasing tax compliance in a laboratory experiment when taxpayers believe that they are facing above-average tax rates. In general, fairness of the tax system was shown to have a significant influence (see for example Bordignon, 1993; Cullis & Lewis, 1997; Spicer, 1986).

Taxpayer interrelations also influence tax compliance. Social norms and moral obligations tied to tax payments nudge individuals towards compliance (Alm & Torgler, 2012; Gordon, 1989). The fear of reputational damage, should one be caught evading taxes, also steers behavior, as illustrated in a laboratory experiment by Blaufus et al. (2017). The authors reveal a 'shame effect'. This effect guides individuals towards tax compliance due to the potential shame of non-compliance. However, the study also unveiled a 'contagion effect' where witnessing others evade taxes reduces one's own inclination towards compliance (see also Frey & Torgler, 2006). This

contagion is particularly pronounced among peer groups, friends, and acquaintances, a sentiment substantiated by various studies (Bordignon, 1993; Feld & Tyran, 2002; Grasmick & Green, 1980).

Some studies delve into intrinsic pressures individuals face. There exists an inherent moral obligation associated with tax payments (Dawes, 1980; Scholz & Pinney, 1995). This internal compulsion, when violated, induces guilt, positioning it as the psychological cost of tax evasion (Dulleck et al., 2016; Gordon, 1989).

In essence, tax compliance is a multifaceted issue, akin to assembling a complex jigsaw puzzle. Yet, a significant portion of the existing literature tends to focus on isolated, one-dimensional constructs to explain tax compliance attitudes. These models test singular items and, upon validation, integrate them as influencing factors. However, this approach presents two challenges addressed in this paper: (1) Predominantly top-down theoretical constructs might overlook critical tax compliance components. A comprehensive understanding mandates incorporating taxpayer perspectives in a bottom-up fashion. (2) The growing list of identified influencing factors complicates practical applicability. There is a pressing need for a unified, actionable framework encapsulating the collective wisdom from tax compliance research. We introduce this framework as the multidimensional Tax Compliance Attitude Inventory (*TCAI*).

2.2 Factor analysis

To ensure a comprehensive representation, our formulation of the TCAI integrates both established research and a novel bottom-up methodology. Our aim is to encompass a diverse range of perspectives and dimensions intrinsic to the tax compliance decision-making process, placing particular emphasis on previously unexplored considerations. To this end, we execute an *initial online survey with genuine taxpayers (N = 201)*, prompting them to delineate decision-pertinent

considerations they entertain while completing their tax return. Preliminary descriptive statistics from this survey are delineated in *Table A.1*. Responses are meticulously reviewed: irrelevant entries are discarded, and analogous submissions are consolidated. This process results in a refined set of 45 distinct items. Complementarily, we incorporate an additional 59 items sourced from tax compliance literature, which signify individual attitudes empirically demonstrated to influence tax compliance behavior. Consequently, our compiled TCAI comprises 104 items (referred to as *TCAI-104*). A detailed enumeration of all items within the TCAI-104, alongside their corresponding literature references, is presented in *Table A.2*,¹ which concurrently offers a synthesized overview of tax compliance attitude literature.

To apply the TCAI-104, we initiate a *second online survey with a sample of genuine taxpayers* ($N = 303$). Participants are presented with statements corresponding to the individual items. Initially, they encounter an introductory text that situates them in the context of completing their tax return. Subsequently, they are prompted to self-evaluate their agreement on a 6-point Likert scale, spanning from “Do not agree at all” to “Fully agree”, regarding the significance of each item in their tax compliance decision-making process. Descriptive statistics from this sample are available in *Table A.1*.

Following this, we employ exploratory factor analysis using the data from the second survey to discern the interrelations between the items and identify the underlying structure. We assign every item to a factor and reduce the number of items per factor in a way that a certain explanatory value is kept. The outcome is a shorter and more concise TCAI that encapsulates individual tax compliance attitudes.

¹ All surveys and the subsequent experiment detailed in this study were facilitated by a reputable market research agency based in Germany. To mitigate potential sequence effects or unintended biases, items were presented to participants in a randomized order. It is worth noting that all surveys and the experiment were administered in German. For the purposes of this manuscript, items have been translated from German to English.

We employ a principal component factor analysis for the exploratory factor analysis. Theoretically, the factor count could span from one to the number of parameters, which, in this scenario, amounts to 104. Selecting the factor count necessitates a balance between explanatory depth and the desired model simplicity. While there is not a definitive approach to ascertain the optimal number of factors, we evaluate four prevalent methods:

1. Kaiser-criterion posits that factors should only be retained if their eigenvalue exceeds one (Kaiser & Dickman, 1959). According to our results, up to 21 factors have an eigenvalue above one. An excerpt of these eigenvalues is accessible in *Table A.3*.
2. Elbow criterion (Cattell, 1966) graphs eigenvalues against factor count, identifying a point (or ‘elbow’) where the introduction of an additional factor does not substantially increase the eigenvalue. Our data indicates this ‘elbow’ occurs at the fourth factor. The associated scree plot is illustrated in *Figure A.1*.
3. Our next strategy involves examining factor loadings for varied factor counts, deploying a Varimax rotation complemented by Kaiser normalization. Beginning with a quartet of factors—suggested by the elbow criterion—we primarily consider items with the highest factor loadings, intending to omit others subsequently. *Table A.4* shows that most loadings are consistent, predominantly hovering around 70%.
4. Our final approach emphasizes the textual coherence of the factors. The four factors resonate thematically with *(i) morale, (ii) monetary benefit, (iii) deterrence, and (iv) authority*. A model with four factors thus emerges as cogent, maintaining thematic clarity. It is worth noting, that this model elucidates 42.64% of the cumulative variance.

The ensuing outcome underscores:

Result 1: *Tax compliance attitude is inherently multidimensional, encapsulating the factors of (i) morale, (ii) monetary benefit, (iii) deterrence, and (iv) authority.*

To effectively operationalize the results of the factor analysis, a curtailment of the items under each factor is imperative. The goal is to maintain a substantial degree of explanatory value while distilling the items to a manageable scope, paving the way for a more concise TCAI. In the process of item selection, emphasis is placed on three primary criteria:

1. Factor loading,
2. Discriminatory power, and
3. Textual coherence.

Items that exhibit a robust factor loading, marked discriminatory power, and minimal textual overlap with other items are prioritized for retention. Conversely, items lacking these attributes are deemed expendable. This meticulous item reduction process culminates in a concise list of 16 items, a significant reduction from the initial 104. Each of the four identified factors encompasses four specific items. Notably, five items emanate from the primary phase of our study, where participants documented decision-relevant thoughts. The remaining 11 items are derivative of established literature.

Subsequent to this reduction, we embarked on another factor analysis, this time exclusively centered on these 16 items, as a robustness check. The results reaffirm the initial item allocation. *Table 1* delineates the streamlined multidimensional *Tax Compliance Attitude Inventory*, denoted as *TCAI-16*.

Table 1: The TCAI-16

Item	Factor						
<p>Please imagine the following situation: In real life, you are faced with the decision to pay taxes (for example, by filling in your tax return). In doing so, you can pay your taxes honestly or you can benefit yourself by unlawfully reducing your total taxes payable through tax evasion. Please read the statements below and decide to what extent you agree with each.</p> <p style="text-align: center;">Do not agree at all Fully agree</p> <p style="text-align: center;"> <table border="1" style="display: inline-table; border-collapse: collapse;"> <tr> <td style="padding: 2px 5px;">1</td> <td style="padding: 2px 5px;">2</td> <td style="padding: 2px 5px;">3</td> <td style="padding: 2px 5px;">4</td> <td style="padding: 2px 5px;">5</td> <td style="padding: 2px 5px;">6</td> </tr> </table> </p>		1	2	3	4	5	6
1	2	3	4	5	6		
When I fill in my tax return, it is especially important to me ...							
... that I do not provide any wrong information.	Moral						
... that I comply with the responsibility towards society to pay taxes in full.	Moral						
... that I fulfil the moral obligation to make my tax contribution.	Moral						
... that I pay all my taxes even if I know that I will not be audited.	Moral						
... that I receive a lot in return.	Monetary benefit						
... that I get the best possible out of it for me.	Monetary benefit						
... that I save money/reduce taxes.	Monetary benefit						
... that I get a tax refund.	Monetary benefit						
... that I only cheat to the point where I can avoid imprisonment.	Deterrence						
... that financial penalties, should I be caught while tax evading, are not too high.	Deterrence						
... that the probability of getting caught while tax evading is not too high.	Deterrence						
... that I do not experience negative social consequences from other members of society should I be caught cheating.	Deterrence						
... that I perceive the distribution of the tax burden as fair.	Authority						
... that I agree with the intended use of my taxes.	Authority						
... that the tax system is easy to understand for the average citizen.	Authority						
... that I have the impression the state has earned the money I provide it with.	Authority						

Notes: The TCAI-16 with introductory text and items that influence tax compliance behavior. Originating from a comprehensive factor analysis, questions are systematically allocated to the four underlying factors: morale, monetary benefit, deterrence, and authority. Through the reduction process, the item count has been streamlined from an initial pool of 104 down to a succinct set of 16. A detailed exposition of these items is presented in *Table A.2*.

3 Factors and tax compliance

With the introduction of the TCAI-16, we have effectively distilled the numerous items pertaining to tax compliance attitude into a more functional size. To further analyze tax compliance behavior, we utilized this condensed inventory in a *third, comprehensive online survey, reaching out to real taxpayers*. This large-scale survey, boasting a sample size of 2,825 respondents, was conducted in Germany across four distinct waves.²

Participants engaged with the TCAI-16, a demographics questionnaire, and various tax compliance variables. Descriptive statistics relevant to this sample are presented in *Table A.1*. We measured tax compliance, the dependent variable, using three distinct methods: The first tax compliance measure (TC1) is derived from the World Values Survey and asks participants about their opinion on tax cheating if there is a chance. Answers can be given on a 10-point Likert scale ranging from “Never justifiable” to “Always justifiable”. The second and third measures are scenario-based measures. In the second, participants are presented with an opportunity to under-report taxable revenue. They then rate their likelihood of doing so on a 10-point Likert scale. The third measure offers a scenario where participants can over-report expenses, with their willingness to do so assessed on a similar 10-point Likert scale. For a consistent interpretation of tax compliance (where higher values signify greater compliance), we inverted the scales for TC1 and TC3 in subsequent analyses. A detailed breakdown of these tax compliance measures, with their adjusted scales, can be found in *Table 2*.

² All conducted regression analyses are repeated with control variables indicating the number of the wave which the individual was included in. Additionally, we repeat analyses using a control separating between waves before and during the Covid-19 pandemic that started while data collection. All results are robust to these variations.

Table 2: Tax compliance measures

Variable	Item	Scale (decoded)
TC1	How do you assess the following statement: Cheating on taxes if you have a chance.	Ten-point response: Ranging from 1 (" <i>Always justifiable</i> ") to 10 (" <i>Never justifiable</i> ").
TC2	<u>Scenario 1:</u> Your annual tax return is due. Imagine that your annual basic income is 60,000 EUR. Furthermore, this year you were able to earn an additional income of 500 EUR from another activity - namely from freelance work. Since this is a freelance job, the information about the income has not been automatically forwarded to the tax office yet. How would you assess your willingness to report the entire additional income of 500 EUR on your tax return?	Ten-point response: Ranging from 1 (" <i>Very low</i> ") to 10 (" <i>Very high</i> ").
TC3	<u>Scenario 2:</u> As part of your annual tax return, the tax office asks you for several pieces of information. Among other things, they ask how much money you personally spent on job expenses in the relevant year. These expenses are called income-related expenses and are tax deductible. Basically, the higher the income-related expenses, the lower the tax to be paid. A component of the income-related expenses are the expenses for work equipment. This includes specialist literature, office supplies and technical equipment such as a computer. Since 2018, receipts no longer have to be submitted with the tax return for income-related expenses. However, the tax office can request these and occasionally does so. Please imagine that last year you spent a total of 274 EUR on specialist literature, office supplies and technical equipment that are clearly related to your job. In addition, you had expenses of 43 EUR, which are also considered as office supplies, but actually have no connection to your professional activity. How would you assess your willingness to state more than the 274 EUR in your tax return?	Ten-point response: Ranging from 1 (" <i>Very high</i> ") to 10 (" <i>Very low</i> ").

Notes: Items used to measure tax compliance behavior. TC1 is taken from *World Value Survey* and measures the general attitude towards tax cheating. TC2 and TC3 are scenarios putting participants in the situation of a tax evasion opportunity and measuring their reaction. Response scales for TC1 and TC3 are reversed for the analysis compared to the original survey to enable homogenous measures where a high response value is going along with high tax compliance.

Independent variables are sourced from the TCAI-16. We aggregate the values of the items under each factor, resulting in the independent variables: *morale*, *monetary benefit*, *deterrence*, and *authority*. In our regression analysis, we control for several demographics and personal attributes, including gender, age, education, employment status, family status, risk preference, religiousness, and income, in alignment with prior studies (Alm, 2019; Grasmick et al., 1991; Hofmann et al., 2017; Kastlunger et al., 2013, Torgler, 2006, 2007).

1. *Education* is quantified by the number of years spent in educational institutions.
2. *Employment Status* is a dummy variable that is set to one for individuals employed either full-time or part-time, and zero otherwise.
3. *Family Status* comprises three dummy variables indicating if an individual is married, divorced/widowed, or has another status, with 'single' being the reference group.
4. *Risk Attitude* is gauged based on the *Socio-Economic Panel* item, where individuals express their risk preferences on a 10-point Likert scale, ranging from 0 (“Not risk-loving at all”) to 10 (“Very risk-loving”).
5. *Religiousness* is a dummy variable set to one if an individual reports praying more than zero times per week on average.
6. *Income* is classified into six brackets, ranging from under 1,000 EUR to over 5,000 EUR of household net income monthly.

Three linear regression models are carried out with tax compliance measured by TC1, TC2 or TC3, respectively. The four factor variables and the controls are included as independent variables. The outcomes of these regressions are presented in *Table 3*.³

³ Full results including controls can be seen in *Table A.5*.

Table 3: Linear regressions – individual factor influences on tax compliance

VARIABLES	(1) TC1	(2) TC2	(3) TC3
Morale	0.1699*** (0.0097)	0.2369*** (0.0130)	0.1403*** (0.0141)
Monetary benefit	-0.0007 (0.0088)	-0.0736*** (0.0119)	-0.0796*** (0.0129)
Deterrence	-0.1036*** (0.0077)	-0.0991*** (0.0104)	-0.0863*** (0.0113)
Authority	-0.0197** (0.0088)	0.0344*** (0.0118)	-0.0115 (0.0128)
Constant	7.2645*** (0.3051)	2.7115*** (0.4116)	5.2028*** (0.4468)
Observations	2,825	2,825	2,825
R-squared	0.3274	0.2654	0.1401
Controls	YES	YES	YES

Notes: In this table, based on the third, large-sampled online survey with real taxpayers ($N = 2,825$) results of three linear regression models are presented using TC1, TC2 and TC3 as dependent variables and the four factors as independent variables. Included controls are gender, age, education, employment status, family status, risk preference, religiousness and income. Full results are displayed in *Table A.5*. All values are rounded to the fourth decimal place. Standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Our findings highlight the diverse impacts of the identified factors on tax compliance. *Morale* consistently shows a positive relationship with tax compliance. As individuals place greater emphasis on morality during tax compliance decisions, their tendency to comply increases. This relationship holds strong showing coefficients that are statistically significant at the 1% level across all three specifications. In contrast, *Monetary Benefit* and *Deterrence* have a negative influence on tax compliance. Except from TC1 for monetary benefit, all coefficients are highly statistically significant.⁴ On the one hand, individuals who value moralistic behavior seem to have higher morale by themselves which fosters tax compliance. Directions of the measured effects are intuitively plausible. On the other hand, individuals who give importance to questions of monetary benefit behave more in line with the standard expected utility model and have a higher willingness to evade. This holds similarly for individuals valuing the deterrence parameters. Even when

⁴ Further analysis regarding TC1 reveals also a significant effect of monetary benefit on tax compliance, when considering an interaction effect between deterrence and monetary benefit. Detailed results can be seen in appendix B.

conscious of potential tax evasion penalties, these individuals often showcase lower compliance levels, mirroring the standard utility model's predictions. Authority, as a factor, yields mixed results. While there is a noticeable negative relationship in TC1, TC2 presents a positive association. The relationship in TC3 remains inconclusive.⁵ From these insights, we derive the subsequent conclusion:

***Result 2:** An increase in importance of the morale (deterrence) factor in the tax compliance decision increases (decreases) tax compliance. Accepting a loss in robustness, the monetary benefit factor has a negative effect on tax compliance, while no clear result can be observed for the authority factor.*

To check whether result 2 also holds for an incentivized background and for out-of-sample data an additional *incentivized online experiment with real taxpayers* ($N = 334$) is conducted. Using the TCAI-16 and different tax compliance measures we observe effects in line with the results presented before. Only for the monetary benefit factor no interaction effect can be observed and significances deteriorate. A detailed analysis can be seen in Appendix C.

4 Cluster analysis

Up to this point, we have efficiently distilled a plethora of items into a succinct questionnaire, elucidating some tax compliance implications. Yet, these findings are not yet sufficiently refined for predictive application in tax compliance behavior. Consider, for instance, a respondent who registers elevated values for both the morale and deterrence factors. Such a profile creates an ambiguity based on our present data. Employing a cluster analysis, derived from the third extensive online survey involving actual taxpayers ($N = 2,825$), we can discern distinct patterns in the expression of our four key factors: morale, monetary benefit, deterrence, and authority. Examining

⁵ To check for robustness of the results, additional regression analyses are conducted without controls. Presented results are robust to this variation.

then the relation of the belonging to a cluster and tax compliance allows predicting tax compliance behavior.

Considering the findings from the preceding section, one might contend that the authority factor, given its ambiguous relationship with tax compliance, may not be critical for clustering aimed at predicting tax compliance. Consequently, there might be an opportunity to refine the Tax Compliance Attitude Inventory to a streamlined 12-item version (*TCAI-12*), eliminating the quartet of questions associated with the authority factor. However, it cannot be explicitly excluded that the authority factor plays a role in the differentiation of tax compliance behavior as we do observe some significances in the values. For instance, there could be undetected interaction effects inhibiting unambiguous results. Therefore, the subsequent analysis will proceed with a dual approach: a cluster analysis encompassing all four factors, as represented in the TCAI-16, and another analysis that focuses on the triad of factors, excluding authority, as represented in the TCAI-12.

To conduct cluster analysis, three decisions must be taken: First, the selection of a distance or similarity measure. Second, it must be decided for an appropriate cluster algorithm. Third, the number of clusters has to be determined. For the present data we use the Euclidian distance as it is commonly used underneath the distance measures (Backhaus et al., 2021). Similarity measures do not seem appropriate as two subjects should be in the same cluster for a low absolute distance between their values and not because of a similar profile indicated by a high correlation. For example, considering two individuals: First individual is showing *high* values for morale and monetary benefit while showing *medium* values for deterrence and authority. The second individual is showing *medium* values for morale and monetary benefit while showing *low* values for deterrence and authority. Using a distance measure both individuals would be treated as relatively different as their absolute values differ significantly. Under a similarity measure both individuals would be assigned to the same cluster because of a high correlation – their profiles perfectly match.

As algorithm we use k-means clustering, as it provides an increased reliability of our results compared to hierarchical clustering. The reason is as follows: It is in the nature of hierarchical clustering that each subject is allocated one after another towards a cluster. As the mean of a cluster changes with every additionally allocated subject, the optimal cluster for an early assigned subject A could be a different cluster in the end. We would use this suboptimal clustering to ultimately determine the clusters and their respective mean values. Moreover, all following conclusions on tax compliance behavior would be based on this clustering. Upon application of our established methodology to classify new data according to previously determined cluster centroids, specifically their mean values, it becomes evident that the extrapolation of tax compliance conclusions may not always be straightforward. Consider, hypothetically, the introduction of a new subject, referred to as 'B', exhibiting values identical to those of an existing subject 'A'. In this scenario, there exists a potential discrepancy where subject B might be assigned to a cluster divergent from the one previously allocated to subject A during the initial clustering phase. Consequently, any predictions derived for subject B's compliance behavior could potentially be rooted in the characteristics of an inapposite cluster. This anomaly underscores the challenges inherent in the clustering approach and can potentially compromise the fidelity and reliability of our resultant analysis.

Contrary to hierarchical clustering, partitional clustering provides the flexibility to alter a subject's cluster assignment post-initial allocation. This adaptability circumvents the aforementioned classification discrepancies. However, the adoption of partitional methods, such as the k-means clustering, does present its own set of challenges. Predominantly, k-means clustering exhibits a proclivity to generate clusters of approximately uniform sizes, potentially overshadowing smaller, yet significant, groups. Furthermore, the inclusion of randomization in the k-means method

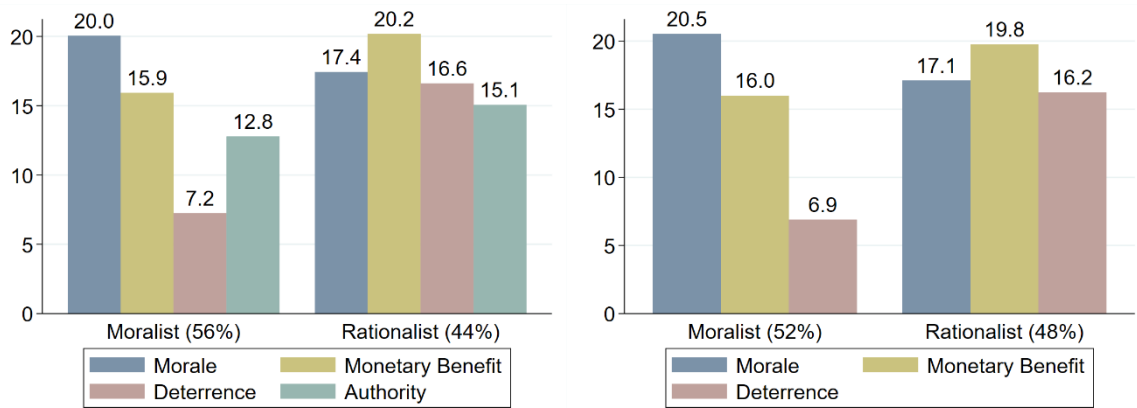
implies that exact replication of results may remain elusive.⁶ Nevertheless, given the minimal magnitude of these deviations, partitional clustering emerges as a more suitable approach for the clustering tasks within this analysis.⁷

To determine the “true” number of clusters various stopping rules are used. First, with plotting the within-cluster sum of squares against the number of clusters, the elbow criterion can be applied. Looking at the results, a two- or three-cluster solution could be arguable. Comparing both kinks, the one in the two-cluster solution seems more present. Especially when using the TCAI-12, the two-cluster solution is more appropriate. The scree plots can be seen in *Figure A.2*. Second, looking at the index by Caliński & Harabasz (1974) which is acknowledged as reliable stopping rule shows similar results (Milligan & Cooper, 1985). Highest pseudo-F values are observed at the two-cluster solution for the TCAI-16 as well as for the TCAI-12. Results can be seen in *Table A.6*. Third, we have a look at the contextual fit. To interpret the clusters, mean values for the factors of the TCAI-16 and the TCAI-12 are displayed in *Figure 1* by cluster.

⁶ We conduct k-means clustering several times to get an indication for the magnitude of deviations. Although mean cluster values for the four factor variables are changing, variations only affect the second decimal place.

⁷ To check for robustness of the results regarding tax compliance we also conduct Ward hierarchical clustering. Although we receive a different clustering of the subjects, the characteristics of the clusters and the relation to tax compliance behavior is qualitatively the same.

Figure 1: Survey data – mean factor values per cluster using TCAI-16 (left) and TCAI-12 (right)



Notes: In this figure different clusters are presented based on the third, large-sampled online survey with real taxpayers ($N = 2,825$). The clustering is made by k-means clustering. The four factor variables morale, monetary benefit, deterrence and authority of the TCAI-16 serve as cluster variables in the left chart and the three factor variables morale, monetary benefit and deterrence of the TCAI-12 in the right chart. The bars represent the average factor value for the corresponding cluster. Values are rounded to the first decimal place. The sample distribution on the clusters is shown in parenthesis and is rounded to the full value.

For both solutions, for the TCAI-16 as well as for the TCAI-12, the *first cluster* is characterized by a high importance of the morale factor and a notably lower importance of the monetary benefit factor. Also, the extremely low value for deterrence offers some implications: For individuals in the first cluster, the standard expected utility model of Allingham and Sandmo (1972) seems to be highly insufficient in describing tax compliance behavior. Notably, the audit probability and penalty structure, pivotal components of this canonical model, function merely as peripheral deterrence determinants when contrasted against other factors. Additionally, the authority factor, although present, manifests a reduced significance when paralleled with the morale factor. Given the preeminence of the morale factor within this cluster, it is aptly christened as representing the 'moralist' archetype. It is noteworthy to mention that moralists represent a significant subset, accounting for 56% of the sample in the TCAI-16 model and 52% in the TCAI-12 framework.

The profile of the *second cluster* shows some differences. Notably, the factors of deterrence and monetary benefit assume heightened salience in influencing tax compliance decisions relative to the 'moralist' classification. Concurrently, while the authority values register an increase, there is a perceptible decline in the emphasis on the morale factor. This trend persists uniformly across

both analytical approaches, underscoring the robustness of the observed patterns. Collectively, the behavioral inclinations of subjects encompassed within this second cluster appear more congruent with the canonical model than their counterparts in the initial cluster. In light of these observations, this cluster is aptly designated as representing the ‘rationalist’ archetype. Within the sample distribution, rationalists constitute 44% under the TCAI-16 framework and 48% within the TCAI-12 paradigm.

When comparing the mean factor values between the two clusters (in addition to the contextual differences), we also check for statistical differences. For this reason, we conduct non-parametric tests to check whether there is a difference between the clusters with respect to each factor (e.g., between the morale values of the moralist and rationalist). Results of the *Mann-Whitney U tests* are of high significance at 0.01% level for all combinations of factors and for the four-factor solution applying the TCAI-16 as well as for the three-factor solution applying the TCAI-12. Overall, after looking at statistics and the contextual fit, two clusters seem to be an appropriate categorization.

To examine how subjects are distributed when using the TCAI-16 compared to when using the TCAI-12, the frequency distribution of the clusters is displayed in *Table 4*. It can be seen that subjects classified as moralist (rationalist) under the TCAI-16 are to a high extent also classified as moralists (rationalists) under the TCAI-12. This is in line with the similarity of both solutions observed in *Figure 1*. Exclusion of the authority factor in the cluster analysis results in an alteration of approximately 5.6% in the clustering pattern. Yet, the implications of this shift—whether it compromises, remains neutral, or potentially augments the predictive accuracy for tax compliance behavior—demand further examination. This assessment will be undertaken in the ensuing section. Based on the current analysis, the subsequent observation can be articulated:

Result 3: Utilizing cluster analysis encompassing either the triad of factors—morale, monetary benefit, and deterrence—or the quartet inclusive of authority, two distinct clusters materialize: the moralist and the rationalist.

Table 4: Frequency distribution of clusters using TCAI-16 and TCAI-12

		TCAI-12		Sum
		Moralist	Rationalist	
TCAI-16	Moralist	1,445	133	1,578
	Rationalist	24	1,223	1,247
Sum		1,469	1,356	2,825

Notes: This table presents the sample distribution of the different clusters. It is shown how individuals are distributed in a four-factor solution using the TCAI-16 compared to a three-factor solution using the TCAI-12.

5 Clusters and tax compliance

5.1 Four-factor (TCAI-16) vs. Three-factor (TCAI-12) clustering

5.1.1 Survey data

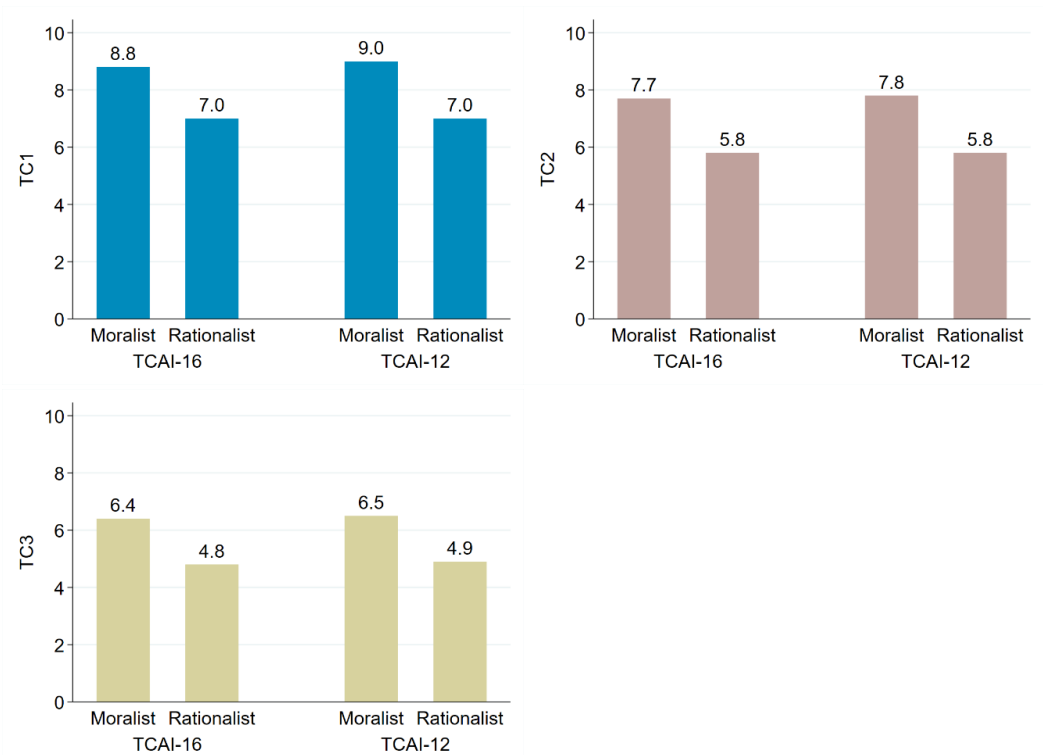
Upon delineation of the clusters, the subsequent inquiry addresses how cluster affiliation correlates with tax compliance behavior. We revert to the comprehensive online survey dataset, encompassing 2,825 real taxpayers, which integrates tax compliance indicators: TC1, TC2, and TC3. The examination bifurcates individuals into the ‘moralist’ and ‘rationalist’ categories. We embark with a presentation of descriptive statistics, subsequently segueing to multivariate analyses. The parallel execution of analyses for both TCAI-16 and TCAI-12 ensures a comprehensive assessment of distinctions attributed to either framework.

A cursory exploration of the descriptive statistics, particularly the disparities in mean values delineated in *Figure 2*, yields notable insights. Across all tax compliance metrics, individuals categorized under the ‘moralist’ cluster consistently register higher values compared to those within

the ‘rationalist’ cluster. These variations lay between 1.6 and 2 units on the 10-point Likert scale, with minimal deviations between TCAI-16 and TCAI-12 methodologies.

Transitioning to multivariate analysis, we employ linear regression. Utilizing the comprehensive taxpayer dataset ($N = 2,825$), we designate TC1, TC2, and TC3 as dependent variables, representing tax compliance. The independent variable, denoted as *Rationalist*, is a dummy construct: it assumes a value of one for individuals nested within the ‘rationalist’ cluster and zero otherwise. With the ‘moralist’ cluster operating as the baseline reference, the coefficient of the variable *Rationalist* measures the difference in tax compliance behavior between the two clusters. Taking the control variables into account we conduct regression analyses for the clustering based on the TCAI-16 and the TCAI-12. Results are displayed in *Table 5*.⁸

Figure 2: Descriptive statistics – mean tax compliance values in the different clusters



Notes: In this figure the mean values for TC1, TC2 and TC3 using the TCAI-16 and the TCAI-12 are presented based on the third, large-sampled online survey with real taxpayers ($N = 2,825$). Values are rounded to the first decimal place.

⁸ Full results including controls can be seen in *Table A.7*.

Table 5: Linear regressions – influence of cluster on tax compliance

CLUSTERING	TCAI-16			TCAI-12		
	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	TC1	TC2	TC3	TC1	TC2	TC3
Rationalist	-1.56*** (0.08)	-1.73*** (0.11)	-1.48*** (0.11)	-1.75*** (0.08)	-1.93*** (0.11)	-1.49*** (0.11)
Constant	9.35*** (0.23)	5.74*** (0.32)	6.04*** (0.33)	9.55*** (0.23)	5.96*** (0.31)	6.14*** (0.33)
Observations	2,825	2,825	2,825	2,825	2,825	2,825
R-squared	0.24	0.13	0.09	0.26	0.14	0.09
Controls	YES	YES	YES	YES	YES	YES

Notes: In this table, based on the third, large-sampled online survey with real taxpayers ($N = 2,825$) results of six linear regression models are presented with TC1, TC2 and TC3 as dependent variables. Models (1), (2) and (3) are based on the TCAI-16 while models (4), (5) and (6) are based on the TCAI-12. *Rationalist* is included as independent variable turning one for individuals in the rationalist cluster, zero otherwise. The moralist cluster is used as reference group. Included controls are gender, age, education, employment status, family status, risk preference, religiousness and income. Full results are displayed in *Table A.7*. All values are rounded to the second decimal place. Standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Coefficients for *Rationalist* are constantly negative through all tax compliance variables over both cluster solutions. Results are highly significant at the 1% level. Hence, we can conclude that rationalists have a higher tendency to cheat on taxes than moralists. Overall, findings are very much in line with results from Section 3. While higher importance of the morale factor leads to increased tax compliance, higher values for monetary benefit and deterrence cause a decrease. We repeat the analyses leaving out control variables. Results are robust to this variation (not reported). We note the following conclusion:

Result 4: *For both, the TCAI-16 and the TCAI-12, individuals in the moralist cluster show higher values for tax compliance than individuals in the rationalist cluster.*

5.1.2 Classification algorithm

In all cases where tax compliance behavior is of interest, our findings could be used as an instrument for segmentation or as a control measure when collecting new data. We present a simple classification algorithm with which every new data set applying the relevant questions can be classified into moralists and rationalists. This can be done independently of the sample size.

The classification algorithm, here presented for the three-factor solution, consists of several steps: *First*, all questions of the TCAI-12 need to be asked with answers based on a 6-point Likert scale (see *table 1*, but without items of the factor authority). An exemplar populated with synthetic data for three participants is depicted in *Table 6*.

Table 6: Exemplary data – answers on the TCAI-12

No.	Morale				Monetary Benefit				Deterrence			
	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12
1	5	6	6	3	3	2	3	1	1	1	2	1
2	5	3	4	5	5	5	5	4	6	4	3	5
3	3	2	4	4	5	6	5	6	5	4	2	5

Notes: Synthetic data to illustrate the application of our results. The data represent answers given on the TCAI-12 for three subjects.

Second, values for the factors morale, monetary benefit and deterrence are calculated for each subject by summing up the scores of the corresponding questions of each factor. Results are shown in *Table 7*.

Table 7: Exemplary data – factor values per subject

No.	Morale	Monetary Benefit	Deterrence
1	20	9	5
2	17	19	18
3	13	22	18

Notes: Fictitious data to illustrate the application of our results. The data represent answers given on the TCAI-12 for three subjects and summed up for each of the three factors morale, monetary benefit and deterrence.

Third, the distance for each subject to each of the clusters needs to be calculated. To secure the classification's explanatory value of tax compliance behavior, it is recommended to use the Euclidian distance. This is because the Euclidian distance is also applied in the cluster analysis. Using a different distance measure could lead to a classification which is not in line with the clustering. Hence, explanatory value of the tax compliance behavior induced by the clustering could be lower. The formula for the Euclidian distance can be seen in equation (1) showing the distance between subject i and cluster c . The factor values f are determined by the factor type j with $j \in [1, 2, 3]$ (or $j \in [1, 2, 3, 4]$ when using the TCAI-16) on the one hand and by subject i or cluster c on the other hand. The factor values of a factor j and a cluster c are defined by the mean factor values from section 4 *Figure 1*, and are shown again in *Table 8*. All new classifications rely on these one-time defined values. Exemplary calculations can be seen below.

$$(1) \quad \| i - c \| = \sqrt{\sum_{j=1}^J (f_{ji} - f_{jc})^2}$$

Table 8: One-time defined factor values per cluster using TCAI-12 and TCAI-16

		TCAI-12			
		Morale	Monetary benefit	Deterrence	
Moralist		20.5	16.0	6.9	
Rationalist		17.1	19.8	16.2	
		TCAI-16			
		Morale	Monetary benefit	Deterrence	Authority
Moralist		20.0	15.9	7.2	12.8
Rationalist		17.4	20.2	16.6	15.1

Notes: In this table the one-time defined factor values are presented for the moralist and for the rationalist cluster in line with *Figure 1*. The upper chart states the three factor values morale, monetary benefit and deterrence for the TCAI-12 and the bottom chart the four factor values morale, monetary benefit, deterrence and authority for the TCAI-16.

The Euclidian distance of subject no. 1 to ...

... the moralist cluster is: $\sqrt{(20 - 20.5)^2 + (9 - 16.0)^2 + (5 - 6.9)^2} = 7.3$

... the rationalist cluster is: $\sqrt{(20 - 17.1)^2 + (9 - 19.8)^2 + (5 - 16.2)^2} = 15.8$

Fourth, subjects are assigned to a cluster. Thereby, the lowest distance value determines the cluster a subject is assigned to. This categorization provides insights into the tax compliance tendencies of the participants, grounded on the regression analyses previously undertaken. The final assignment step can be seen in *Table 9*. The procedure for the TCAI-16 is similar. Only differences are the inclusion of the authority factor in every step and the change in the one-time defined factor values per cluster.

Table 9: Exemplary data – Euclidian distance and cluster assignment

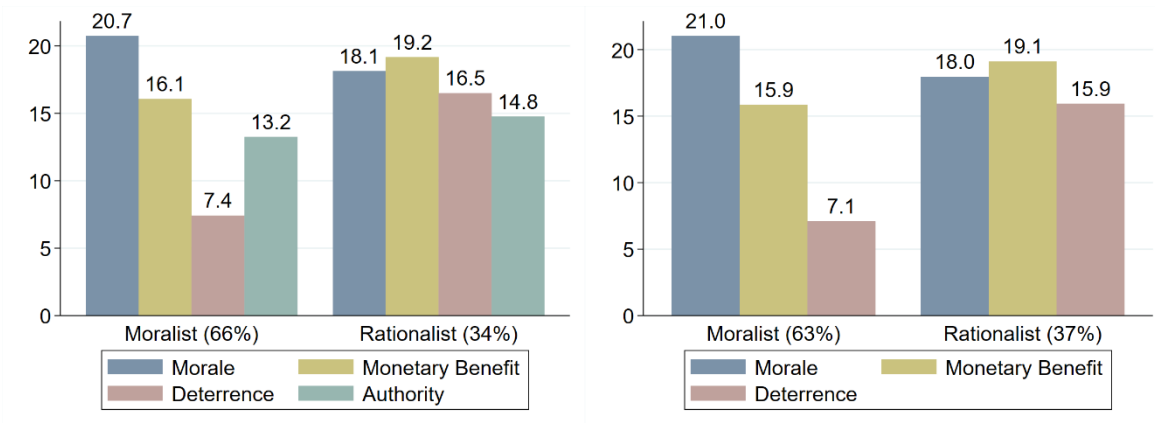
No.	Moralist	Rationalist	Cluster
1	7.3	15.8	Moralist
2	12.0	2.0	Rationalist
3	14.7	5.0	Rationalist

Notes: Synthetic data to illustrate the application of our results. The data show for each of the three subjects the Euclidian distance to each of the two clusters. Calculations are based on the average cluster values per factor of the three-factor solution presented in *Figure 1* and *Table 8*. All values are rounded to the first decimal place.

5.1.3 Experiment data

To demonstrate applicability of the classification algorithm in out-of-sample data and check for robustness of the implications made about tax compliance behavior we again use the incentivized online experiment data with real taxpayers ($N = 334$). We classify the data based on the TCAI-16 and the TCAI-12. As distance measure we use the Euclidian distance as recommended. Results of the classification can be seen in *Figure 3*.

Figure 3: Experiment data – mean factor values per cluster using TCAI-16 (left) and TCAI-12 (right)



Notes: In this figure different clusters are presented based on the incentivized online experiment with real taxpayers ($N = 334$). The clustering is made based on the Euclidian distance of the four factors to the average values of the pre-defined clusters from *Figure 1* and *Table 8*. Results are shown for the TCAI-16 and TCAI-12. The bars represent the average factor value for the corresponding cluster. Values are rounded to the first decimal place. The sample distribution on the clusters is shown in parenthesis and is rounded to the full value.

Despite the smaller sample size, we find similar factor manifestations as in the main cluster analysis. Using the TCAI-12 instead of the TCAI-16 causes a change in the classification of 6.9%. Descriptive and multivariate analyses are carried out to examine whether the predicted differences in tax compliance behavior between the clusters hold. Results point in the same direction as seen before. Detailed analyses can be seen in Appendix D. The following result arises:

Result 5: *With the classification algorithm we are able to split up new data in our defined clusters and show the predicted differing tax compliance behavior among the clusters. Observed tax compliance effects are robust towards a smaller sample and against an incentivized background.*

Finally, concluding remarks have to be made on the selection of the appropriate number of factors. First, using the TCAI-12 instead of the TCAI-16 would reduce the number of items needed in the questionnaire from 16 to 12. This leads to time-related advantages increasing applicability of the TCAI-12. Second, coefficients of multivariate analyses show to be slightly more distinctive when using TCAI-12 instead of TCAI-16. Overall, arguments for a three-factor clustering with the TCAI-12 prevail.

5.2 One-factor (TCAI-4) classification

In a final step we now examine whether we can reduce questions in the classification (not in the cluster analysis as in the reduction from TCAI-16 to TCAI-12) up to a single factor (*TCAI-4*). The goal is to receive a classification that is as similar as possible to the TCAI-12 classification. Applicability of our results would increase with less questions to be asked. In other words, the rationale behind this endeavor is the enhanced practicality: a concise set of questions would expedite the survey process and enhance its applicability.

To identify the factor that splits up the sample best we look at the mean factor values per cluster of the TCAI-12 from *Figure 1* and *Table 8*. Factors with a higher difference in the mean value between the two clusters seem more appropriate to be used as a single separator. It can be seen that the difference between the morale values with 3.4 ($= 20.5 - 17.1$) and between the monetary benefit values with 3.8 is lower than between the deterrence values with 9.3. Hence, we continue with the deterrence factor as single separator.⁹

To examine how suitable the deterrence factor is we split a sample into moralists and rationalists applying the third, large-sampled online survey data ($N = 2,825$) and the incentivized online experiment data involving real taxpayers ($N = 334$). In each dataset, we employed the classification algorithm relying solely on the deterrence factor, calibrated against the established mean values: 6.9 for moralists and 16.2 for rationalists. Relative to the respective clustering, there is an alteration of 8.3% in the expansive dataset and an 8.7% shift in the experimental dataset. Subsequently, by juxtaposing the outcomes of multivariate analyses with the insights gleaned from prior sections, we aim to ascertain the robustness and validity of the TCAI-4's single-factor classification.

We use linear regression analyses including the dependent variables TC1, TC2, TC3 and TC1Exp, respectively. Moreover, we apply a logistic regression analysis using the incentivized variable

⁹ We additionally check for distinctiveness on a question level. However, the four most distinctive single questions are the ones allocated to the deterrence factor.

TCExp. *Rationalist* and the control variables serve as independent variables. The results are displayed in *Table 10*. The coefficients for *Rationalist* in all regression models consistently yield negative values and maintain a high significance level at $p < 0.01$. As previously observed, individuals within the ‘moralist’ cluster evade less taxes than individuals within the ‘rationalist’ cluster. If compared to the corresponding coefficients in *Tables 5* and *D.1*, coefficients here show to have a less negative value. Concurrently, the R-squared as well as pseudo R-squared are slightly lower. Thus, using the TCAI-4 (based only on the deterrence questions) in the classification of new data leads to a less precise prediction of tax compliance behavior than using the TCAI-12. Nonetheless, the optimal methodology hinges on the specific use case, as the TCAI-4 offers the intrinsic benefit of necessitating a reduced number of queries. This leads us to the subsequent observation:

Result 6: *Utilizing the TCAI-4 allows for the categorization of datasets into 'moralists' and 'rationalists', albeit with a slight compromise in precision.*

Table 10: One-factor classification – influence of cluster on tax compliance

VARIABLES	(1) TC1	(2) TC2	(3) TC3	(4) TC1Exp	(5) TCExp
Rationalist	-1.56*** (0.08)	-1.64*** (0.11)	-1.31*** (0.12)	-1.62*** (0.24)	-1.29*** (0.34)
Constant	9.54*** (0.23)	5.90*** (0.32)	6.12*** (0.33)	9.59*** (0.83)	1.01 (1.13)
Observations	2,825	2,825	2,825	334	334
R-squared	0.24	0.12	0.08	0.27	
Pseudo R-squared					0.14
Controls	YES	YES	YES	YES	YES

Notes: In this table, based on the third, large-sampled online survey with real taxpayers ($N = 2,825$) results of three linear regression models are presented with TC1, TC2 and TC3 as dependent variables. Based on the incentivized online experiment data with real taxpayers ($N = 334$), results of a linear regression model using TC1Exp as dependent variable and a logistic regression model using TCExp as dependent variable are presented. *Rationalist* is included as independent variable turning one for individuals in the rationalist cluster, zero otherwise. The moralist cluster is used as reference group. The allocation towards a cluster is made by the one-factor classification. Included controls are gender, age, education, employment status, family status, risk preference, religiousness and income. The independent variable “other family status” is excluded in the logistic regression as it predicts success perfectly. All values are rounded to the second decimal place. Standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

6 Discussion and conclusion

In this paper we apply a bottom-up approach, creating an applicable taxpayer typology based on taxpayer surveys and present research in the field. Previous works have endeavored to delineate diverse taxpayer types, but predominantly leaned on qualitative methodologies for derivation. In the following, two approaches are shown and the results connected to those of the present article. Based on the early work of Kelman (1965), Vogel (1974) creates three types of taxpayers: The ‘complier’ pays taxes for fear of the consequences of not doing so. The ‘identifier’ is influenced by social norms and perceives paying taxes as a moral obligation. As third taxpayer type the author defines the ‘internalizers’ complying with the tax law because it is consistent with their own value system. In the context of our research, the ‘complier’ can be associated with a pronounced emphasis on the deterrence factor, specifically considering the significance of varied penalty forms. Analogously, while the complier mirrors the characteristics of the rationalist, both the identifier and internalizer resonate more closely with the traits of the moralist.

In a later work, Torgler (2003) defines four taxpayer types. The ‘social taxpayer’, similar to the identifier, and the ‘honest taxpayer’, similar to the internalizer, would be close to the moralist cluster. The ‘intrinsic taxpayer’ focusses on reciprocity in the citizen-government relationship. This taxpayer type does not fit to one of our derived clusters. It could be described by a high value of the authority factor. But as seen before, the importance of the authority factor does not have a notable effect on tax compliance behavior. Last type is the ‘tax evader’, which is closely related to the rationalist cluster. Only concentrating on an expected utility calculation, the tax evader would cheat on taxes, congruent with the standard model. Conclusions for the tax evader are in line with empirical results of the present paper. However, the results additionally imply that the clustering is not explicit. There are compliant rationalists as well as cheating moralists.

In sum, our findings have important practical implications. Especially governments and tax authorities can profit in several ways: Applying our approach could help to receive cues about the

tax compliance preferences of citizens and implement preventive countermeasures. Moreover, with a more in-depth knowledge of its citizens' tax compliance motivation, governments and tax authorities could expand and improve the use of choice architecture to foster tax compliant behavior. Tapping into these nuanced motivations, governments and tax authorities can design more targeted behavioral interventions to promote tax compliance. For instance, reminders for tax filings might be more effective if they are tailored to the specific motivations of the recipient. Instead of a generic reminder, a message that speaks to an individual's specific concerns or motivations could prove more compelling. Thus, future research could focus on the further exploration of behavioral differences between the clusters. For instance, there could be a different reaction to behavioral tax compliance interventions in dependence of the cluster. However, this approach is limited by citizens consciously giving answers in a way they want to be perceived by the government. Addressing future research, also the composition of the monetary benefit factor and the relevance of its components for the tax compliance decision should be of matter. We can show that monetary benefit is not a single attribute but is including various facets (e.g., reduction of taxable income, avoidance of tax arrears). Ultimately, as we continue to refine our understanding of tax compliance motivations, we inch closer to creating systems that are both efficient for governments and accommodating for citizens.

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Appendix A

Table A.1: Descriptive sample statistics

Variable	Description	Survey	Survey	Survey	Experi- ment
		<i>N</i> = 201	<i>N</i> = 303	<i>N</i> = 2,825	<i>N</i> = 334
Age	in years	48.66	48.03	43.38	55.83
Gender	male = 1; 0 otherwise	49.75%	49.18%	49.74%	52.54%
Education	in years at educational institutions	14.53	13.95	14.23	13.58
Employment status	full-time/part-time employed = 1; 0 otherwise	68.66%	69.31%	74.66%	57.02%
Family Status					
Single	single = 1; 0 otherwise	33.33%	32.01%	33.98%	26.35%
Married	married = 1; 0 otherwise	49.25%	47.52%	55.97%	51.80%
Divorced/Widowed	divorced/widowed = 1; 0 otherwise	15.92%	17.49%	8.78%	20.06%
Other	other = 1; 0 otherwise	1.49%	2.97%	1.27%	1.80%
Risk attitude	0 = not risk-loving at all; 10 = very risk-loving	4.62	3.99	4.76	4.41
Religiousness	1 = praying > zero times/week; 0 otherwise	41.29%	32.67%	32.32%	36.42%
Household net income in EUR					
0 - 1,000		13.93%	15.51%	11.01%	17.66%
1,001 - 2,000		26.37%	29.04%	17.49%	28.14%
2,001 - 3,000		27.36%	23.43%	23.43%	26.65%
3,001 - 4,000		18.91%	18.48%	21.73%	14.97%
4,001 - 5,000		9.45%	9.57%	16.81%	6.59%
Above 5,000		3.98%	3.96%	9.52%	5.99%

Notes: Descriptive sample statistics are presented for the first online survey ($N = 201$), the second online survey ($N = 303$), the third, large-sampled online survey ($N = 2,825$) and the incentivized online experiment ($N = 334$) with real taxpayers. All values are rounded to the second decimal place.

Table A.2: Overview of introduction text and items

Var	Item	Source
<div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 0 auto;"> <p>Please imagine the following situation: In real life, you are faced with the decision to pay taxes (for example, by filling in your tax return). In doing so, you can pay your taxes honestly or you can benefit yourself by unlawfully reducing your total taxes payable through tax evasion. Please read the statements below and decide to what extent you agree with each.</p> </div>		
	When I fill in my tax return, it is especially important to me ...	
v1	... that there are no conflicts with my personal values and standards.	(Alm & Torgler, 2012; Dulleck et al., 2016; Torgler, 2003; Torgler & Schneider, 2005; Vogel, 1974)
v2	... that my friends and family will not think anything bad of me.	(Blaufus et al., 2017; Erard & Feinstein, 1994; Kirchler, 2007)
v3	... that I fulfil the moral obligation to make my tax contribution.	(Alm & Torgler, 2012; Cullis et al., 2012; Frey, 1997; Torgler & Schneider, 2005; Vogel, 1974)
v4	... that I do not feel bad afterwards because I made false statements.	(Andreoni et al., 1998; Dulleck et al., 2016; Erard & Feinstein, 1994)
v5	... that my sense of duty to pay taxes is not violated.	(Alm & Torgler, 2012; Cullis et al., 2012; Dulleck et al., 2016; Frey, 1997; Torgler, 2003; Vogel, 1974)
v6	... that I do not do anything that could mean a break with my religious beliefs.	(Grasmick et al., 1991; Hull & Bold, 1994; Lipford et al., 1993; Torgler, 2005)
v7	... that there are people in my circle of acquaintances who behave in a similar way.	(Blaufus et al., 2017; Frey & Torgler, 2007; Traxler, 2010)
v8	... that my self-image of declaring taxes honestly is fulfilled.	(Alm & Torgler, 2012; Dulleck et al., 2016; Torgler, 2003; Vogel, 1974)
v9	... that the probability of getting caught while tax evading is not too high.	(Allingham & Sandmo, 1972; Alm et al., 1990, 1995; Alm, Jackson, et al., 1992b; Alm, McClelland, et al., 1992; Beck et al., 1991; Friedland et al., 1978; Kirchler, 2007; Kleven et al., 2011; Scholz & Pinney, 1995; Witte & Woodbury, 1985)
v10	... that financial penalties, should I be caught while tax evading, are not too high.	(Allingham & Sandmo, 1972; Alm et al., 1990, 1995; Alm, Jackson, et al., 1992b; Beck et al., 1991; Friedland et al., 1978)
v11	... that the criminal consequences, should I be caught, are not too high for me.	(Allingham & Sandmo, 1972; Alm et al., 1990, 1995; Alm, Jackson, et al., 1992b; Beck et al., 1991; Friedland et al., 1978)
v12	... that I only evade enough to avoid financial punishment.	(Allingham & Sandmo, 1972; Alm et al., 1995; Alm, Jackson, et al., 1992b; Beck et al., 1991; Friedland et al., 1978)
v13	... that I only cheat to the point where I can avoid imprisonment.	(Allingham & Sandmo, 1972; Alm et al., 1990, 1995; Alm, Jackson, et al., 1992b; Beck et al., 1991; Friedland et al., 1978; Schwartz & Orleans, 1967)
v14	... that I only evade enough that the probability of future tax audits does not increase for me.	(Bergolo et al., 2023; DeBacker et al., 2018; Erard, 1992; Kleven et al., 2011; Slemrod et al., 2001)
v15	... that my personal tax rate is not too high.	(Allingham & Sandmo, 1972; Alm et al., 1990; Alm, Jackson, et al., 1992b; Clotfelter, 1983; Friedland et al., 1978)
v16	... that my tax payable is not too high.	(Allingham & Sandmo, 1972; Alm et al., 1990; Alm, Jackson, et al., 1992b; Clotfelter, 1983; Friedland et al., 1978)
v17	... that my taxable income is not too high.	(Allingham & Sandmo, 1972; Alm, Jackson, et al., 1992b)

v18	... that I achieve a great financial benefit for myself.	(Allingham & Sandmo, 1972; Alm, Jackson, et al., 1992b)
v19	... that the tax payment does not mean a substantial financial disadvantage for me.	(Allingham & Sandmo, 1972; Alm, Jackson, et al., 1992b)
v20	... that I behave as in comparable situations.	(Alm, 2019; Cullis & Lewis, 1997; Dulleck et al., 2016; Torgler, 2003; Torgler & Schneider, 2005; Vogel, 1974)
v21	... that I do not take too much of a risk.	(Alm, 2019; Kirchler, 2007)
v22	... that the tax system is easy to understand for the average citizen.	(Alm et al., 2010; Alm, Jackson, et al., 1992a; Andreoni et al., 1998; Dubin et al., 1992; Erard, 1993, 1997; Hofmann et al., 2017; Long & Caudill, 1987)
v23	... that I pay all my taxes even if I know that I will not be audited.	(Alm, McClelland, et al., 1992)
v24	... that I will not go so far as to make tax avoidance illegal.	(McBarnet, 2001, 2004)
v25	... that I can narrow down the level of audit probability as precisely as possible.	(Alm et al., 2010; Alm, Jackson, et al., 1992a; Dubin et al., 1992; Erard, 1993, 1997; Long & Caudill, 1987)
v26	... that I am informed as accurately as possible about the consequences of tax evasion.	(Alm et al., 2010; Alm, Jackson, et al., 1992a; Andreoni et al., 1998; Dubin et al., 1992; Erard, 1993, 1997; Long & Caudill, 1987)
v27	... that my past interactions with governmental authorities, especially tax authorities, have been positive.	(Erard, 1992; Feld & Frey, 2002, 2005, 2007; Kastlunger et al., 2013; Kirchler, 2007; Kirchler et al., 2008; Tittle, 1980; Tyler, 2006; Wahl et al., 2010)
v28	... that my opinion on the use of tax revenue receives sufficient attention.	(Alm et al., 1993; Doerrenberg, 2015; Feld & Frey, 2002; Lamberton et al., 2018; Li et al., 2011)
v29	... that thoughts of the tax authorities do not trigger any negative associations in me.	(Erard, 1992; Feld & Frey, 2002, 2005, 2007; Kastlunger et al., 2013; Kirchler, 2007; Kirchler et al., 2008; Tittle, 1980; Tyler, 2006; Wahl et al., 2010)
v30	... that I have already received help from state authorities, especially the tax authorities, with a request.	(Erard, 1992; Feld & Frey, 2002, 2005, 2007; Kastlunger et al., 2013; Kirchler, 2007; Kirchler et al., 2008; Tittle, 1980; Tyler, 2006; Wahl et al., 2010)
v31	... that state institutions are not wasteful with tax money.	(Alm et al., 1993; Doerrenberg, 2015; Lamberton et al., 2018; Li et al., 2011; Torgler & Schneider, 2009)
v32	... that I feel positively encouraged to cooperate with the tax authorities.	(Erard, 1992; Feld & Frey, 2002, 2005, 2007; Kastlunger et al., 2013; Kirchler, 2007; Kirchler et al., 2008; Tittle, 1980; Tyler, 2006; Wahl et al., 2010)
v33	... that I would describe the work of state institutions as efficient.	(Li et al., 2011; Torgler & Schneider, 2009)
v34	... that I have the impression the state has earned the money I provide it with.	(Feld & Frey, 2002; Kastlunger et al., 2013; Kinsey et al., 1991; Wahl et al., 2010)
v35	... that the state has done something positive for me in the past.	(Erard, 1992; Feld & Frey, 2002, 2005, 2007; Kastlunger et al., 2013; Kirchler, 2007; Kirchler et al., 2008; Tittle, 1980; Tyler, 2006; Wahl et al., 2010)
v36	... that I receive or have received transfer payments that are comparable to the tax payments I have made.	(Cowell & Gordon, 1988; Kinsey et al., 1991; Kirchler, 1998; Scott & Grasmick, 1981)
v37	... that lower tax revenues do not impair the functioning of the state.	(Alm, 2019; Kirchler, 1998; Myles & Naylor, 1996; Traxler, 2010; Vogel, 1974)
v38	... that I agree with the intended use of my taxes.	(Alm et al., 1993; Doerrenberg, 2015; Lamberton et al., 2018; Li et al., 2011)
v39	... that I perceive the distribution of the tax burden as fair.	(Cullis & Lewis, 1997; Erard & Feinstein, 1994; Hofmann et al., 2008; Spicer, 1986; Spicer & Becker, 1980; Wenzel, 2003)
v40	... that the distribution of the tax burden is beneficial to me personally.	(Cullis & Lewis, 1997; Erard & Feinstein, 1994; Hofmann et al., 2008; Wenzel, 2003)

v41	... that the process of tax collection is appropriate.	(Cullis & Lewis, 1997; Feld & Frey, 2007; Hofmann et al., 2008; Spicer & Becker, 1980; Wenzel, 2003)
v42	... that people who evade taxes are also consistently prosecuted and punished.	(Cullis & Lewis, 1997; Feld & Tyran, 2002; Hofmann et al., 2008; Wenzel, 2003)
v43	... that other people are not better at avoiding high tax payments legally or illegally.	(Cullis & Lewis, 1997; Erard & Feinstein, 1994; Spicer, 1986)
v44	... that other people I know (relatively speaking) do not pay less taxes than I do.	(Cullis & Lewis, 1997; Erard & Feinstein, 1994; Hofmann et al., 2008; Spicer, 1986; Spicer & Becker, 1980; Wenzel, 2003)
v45	... that I would describe myself as an above-average honest taxpayer compared to my social environment.	(Alm, Jackson, et al., 1992b; Cullis & Lewis, 1997; Erard & Feinstein, 1994; Fortin et al., 2007; Kim, 2003; Traxler, 2010)
v46	... that the overall tax burden for citizens is not too high.	(Erard & Feinstein, 1994; Kinsey et al., 1991)
v47	... that similarly high taxes are paid in other countries.	(Erard & Feinstein, 1994; Hofmann et al., 2008; Kinsey et al., 1991)
v48	... that my taxes help to finance public services such as kindergartens and schools.	(Alm et al., 1990; Cowell & Gordon, 1988)
v49	... that my friends, family and neighbors contribute to society just as I do.	(Alm, Jackson, et al., 1992b; Bordignon, 1993; Cullis & Lewis, 1997; Erard & Feinstein, 1994; Fortin et al., 2007; Grasmick & Green, 1980; Kim, 2003; Traxler, 2010)
v50	... that I comply with the responsibility towards society to pay taxes in full.	(Alm & Torgler, 2012; Fortin et al., 2007; Kim, 2003; Myles & Naylor, 1996; Traxler, 2010)
v51	... that those people who benefit from my taxes deserve it.	(Alm, Jackson, et al., 1992b; Blaufus et al., 2017; Bordignon, 1993; Cullis & Lewis, 1997; Erard & Feinstein, 1994; Kinsey et al., 1991; Spicer, 1986)
v52	... that I myself have already benefited from the taxes paid by others.	(Bordignon, 1993; Kinsey et al., 1991)
v53	... that I am satisfied with the social structures.	(Bordignon, 1993; Kim, 2003; Kinsey et al., 1991)
v54	... that no social norms are violated by evading taxes.	(Alm & Torgler, 2012; Dulleck et al., 2016; Fortin et al., 2007; Kim, 2003; Myles & Naylor, 1996; Traxler, 2010)
v55	... that I do not experience negative social consequences from other members of society should I be caught cheating.	(Alm & Torgler, 2012; Blaufus et al., 2017; Erard & Feinstein, 1994; Gordon, 1989)
v56	... that other taxpayers are also honest.	(Alm, Jackson, et al., 1992b; Blaufus et al., 2017; Bordignon, 1993; Cullis & Lewis, 1997; Erard & Feinstein, 1994; Feld & Tyran, 2002; Grasmick & Green, 1980; Spicer, 1986)
v57	... that, from my point of view, tax revenues are used wisely.	(Alm et al., 1993; Doerrenberg, 2015; Li et al., 2011)
v58	... that other citizens benefit greatly from my taxes.	(Bordignon, 1993; Kinsey et al., 1991)
v59	... that I save taxes, even if I have to declare some expenses fictitiously.	(McBarnet, 2001, 2004)
v60	... that I fill in everything conscientiously and correctly.	Survey
v61	... that I get money/taxes back.	Survey
v62	... that I do not forget to declare any income.	Survey
v63	... that I do not forget to declare any expenses/income-related costs.	Survey
v64	... that I don't pay too much tax.	Survey
v65	... that I haven't forgotten anything.	Survey
v66	... that filling out the tax return is not too complicated.	Survey
v67	... that my actions do not have negative consequences for my job.	Survey
v68	... that my actions do not have negative consequences for my reputation in my social environment.	Survey
v69	... the tax amount.	Survey
v70	... that I receive a lot in return.	Survey
v71	... that I get as much as possible refunded by the tax authorities.	Survey
v72	... that I save a lot of taxes.	Survey
v73	... that I do not have to pay any taxes in arrears.	Survey

v74	... that I get a tax refund.	Survey
v75	... that everything is clear and comprehensible.	Survey
v76	... how I can legally minimize taxes.	Survey
v77	... that I have a personal advantage.	Survey
v78	... that I understand everything so that I don't do anything wrong.	Survey
v79	... that I do not accidentally declare something wrong.	Survey
v80	... that I save money/reduce taxes.	Survey
v81	... that I do not take any risks.	Survey
v82	... that I have not forgotten anything and that everything is complete.	Survey
v83	... that I also take a risk sometimes.	Survey
v84	... that I exceed the flat rate allowance for expenses/income-related costs.	Survey
v85	... that I go to the limit.	Survey
v86	... that I do not give to the state.	Survey
v87	... that I do not lie.	Survey
v88	... that I save taxes in an honest way.	Survey
v89	... that I do not pay too many taxes.	Survey
v90	... that I have declared all minor things in the income.	Survey
v91	... that I have declared all the little things in expenses/income-related costs.	Survey
v92	... that I can avoid paying tax or tax arrears.	Survey
v93	... that filling in the tax return is worthwhile for me.	Survey
v94	... that I have receipts for all the information I have provided.	Survey
v95	... that I do not invest too much effort in filling out the tax return.	Survey
v96	... that I do not provide any wrong information.	Survey
v97	... that I take advantage of all tax regulations in order to save taxes.	Survey
v98	... that I save taxes even if I have to make dishonest statements.	Survey
v99	... that I do not commit tax evasion just to save taxes.	Survey
v100	... that I will round up information generously in order to save taxes.	Survey
v101	... that I exhaust all legal possibilities to save taxes.	Survey
v102	... that I sometimes set expenses higher in order to save taxes.	Survey
v103	... that I do not underestimate expenses/income-related costs.	Survey
v104	... that I get the best possible out of it for me.	Survey

Notes: This table gives an overview of the Tax Compliance Attitude Inventory (TCAI) with the variable code, the item and the source. The source is either the literature, indicated with the respective work, or the first online survey with real taxpayers ($N = 201$), here only indicated as survey.

Table A.3: Eigenvalues per number of factors

Factor	Eigen-value	Factor	Eigen-value	Factor	Eigen-value
Factor1	21.04544	Factor36	0.7216	Factor71	0.3009
Factor2	11.34309	Factor37	0.68742	Factor72	0.29157
Factor3	7.83154	Factor38	0.67521	Factor73	0.28574
Factor4	3.9998	Factor39	0.66792	Factor74	0.27926
Factor5	2.29041	Factor40	0.66674	Factor75	0.26637
Factor6	1.96871	Factor41	0.64974	Factor76	0.26261
Factor7	1.75224	Factor42	0.62734	Factor77	0.25156
Factor8	1.69506	Factor43	0.6057	Factor78	0.24852
Factor9	1.55886	Factor44	0.59595	Factor79	0.24312
Factor10	1.51617	Factor45	0.59315	Factor80	0.23839
Factor11	1.45122	Factor46	0.57277	Factor81	0.23071
Factor12	1.39643	Factor47	0.56671	Factor82	0.21492
Factor13	1.34693	Factor48	0.55219	Factor83	0.21066
Factor14	1.31031	Factor49	0.53434	Factor84	0.20496
Factor15	1.26603	Factor50	0.52446	Factor85	0.20219
Factor16	1.22371	Factor51	0.51103	Factor86	0.19141
Factor17	1.16153	Factor52	0.49258	Factor87	0.18477
Factor18	1.14756	Factor53	0.48543	Factor88	0.17846
Factor19	1.13373	Factor54	0.46638	Factor89	0.17265
Factor20	1.04742	Factor55	0.4592	Factor90	0.16868
Factor21	1.03251	Factor56	0.44881	Factor91	0.16023
Factor22	0.98097	Factor57	0.43043	Factor92	0.15157
Factor23	0.96542	Factor58	0.41936	Factor93	0.14625
Factor24	0.93986	Factor59	0.40365	Factor94	0.1409
Factor25	0.93061	Factor60	0.39921	Factor95	0.14017
Factor26	0.89594	Factor61	0.39485	Factor96	0.12647
Factor27	0.88538	Factor62	0.37446	Factor97	0.12187
Factor28	0.83193	Factor63	0.36441	Factor98	0.11921
Factor29	0.82266	Factor64	0.35359	Factor99	0.11198
Factor30	0.81785	Factor65	0.34992	Factor100	0.1067
Factor31	0.8023	Factor66	0.33657	Factor101	0.10366
Factor32	0.7964	Factor67	0.3348	Factor102	0.10288
Factor33	0.76637	Factor68	0.32387	Factor103	0.09297
Factor34	0.75226	Factor69	0.32292	Factor104	0.08416
Factor35	0.73684	Factor70	0.30736		

Notes: This tables shows based on principal component factor analysis for the survey data ($N = 303$) the Eigenvalues per number of factors used. Results are rounded to the fifth decimal place.

Table A.4: Sorted factor loadings using four factors

Variable	Factor1	Factor2	Factor3	Factor4	Uniqueness
v95	0.7418	0.1956	-0.1319	0.0777	0.388
v50	0.7198	-0.134	-0.071	0.2026	0.4178
v8	0.7063	0.1199	-0.2644	0.154	0.3932
v3	0.7061	-0.0795	-0.0477	0.2223	0.4435
v23	0.6969	0.0802	-0.2081	0.1741	0.4342
v86	0.6917	0.0847	-0.242	0.0282	0.455
v59	0.6862	0.212	-0.2527	0.0443	0.4184
v61	0.6552	0.1898	-0.1217	-0.0159	0.5197
v5	0.6539	0.0175	0.0997	0.2714	0.4886
v45	0.6348	0.023	0.2301	0.0532	0.5407
v64	0.6065	0.3865	-0.148	0.0646	0.4567
v78	0.5965	0.1921	-0.0314	0.0975	0.5969
v49	0.5789	0.0598	0.1872	0.2108	0.5818
v32	0.5777	0.1201	0.0972	0.3887	0.4913
v81	0.5756	0.4327	-0.2292	0.0533	0.4261
v80	0.5692	0.2678	-0.2115	0.0286	0.5588
v20	0.5622	0.0845	0.0807	0.147	0.6487
v42	0.558	0.0874	-0.2638	0.1655	0.5841
v93	0.5574	0.2165	-0.0621	-0.0166	0.6383
v98	0.543	0.1062	-0.341	0.2055	0.5354
v1	0.5217	0.1859	0.0597	0.2145	0.6438
v67	0.5182	0.0358	0.2994	0.1317	0.6232
v87	0.5086	0.4646	-0.2512	0.1173	0.4486
v89	0.4862	0.2641	-0.1553	-0.0051	0.6697
v48	0.4524	0.1581	0.1584	0.2869	0.6629
v29	0.4466	0.1382	0.1738	0.3632	0.6194
v2	0.4366	-0.0296	0.4107	0.2652	0.5695
v77	0.4291	0.366	-0.1247	0.2933	0.5804
v74	0.4231	0.3416	-0.1801	0.2846	0.5908
v27	0.4176	0.2382	0.0569	0.304	0.6732
v6	0.2857	-0.1372	0.187	0.1773	0.8332
v24	0.2035	0.1714	0.1009	0.0824	0.9122
v4	0.1749	0.1151	0.0744	0.1638	0.9238
v69	-0.0531	0.7291	0.1097	0.1251	0.4379
v79	0.0667	0.7253	0.0401	0.1558	0.4437
v103	0.0807	0.7244	0.0969	-0.0103	0.4592
v73	0.1094	0.7194	0.0731	0.0003	0.4651
v71	-0.0483	0.7175	0.129	0.1289	0.4495
v70	0.1247	0.7134	0.0636	-0.0086	0.4714
v60	0.1134	0.7094	0.0928	0.0908	0.4671
v88	0.1725	0.7002	-0.0633	0.1195	0.4617
v100	0.1854	0.6707	-0.0074	-0.067	0.5112
v85	0.1434	0.6679	0.0456	-0.1163	0.5177
v16	0.1172	0.6441	0.1302	0.2123	0.5094
v15	0.0404	0.636	0.0401	0.3189	0.4906
v96	0.163	0.6281	0.0296	0.0079	0.578

v92	0.0293	0.618	0.1127	0.277	0.5278
v75	0.1004	0.6164	0.03	0.0334	0.608
v91	0.1209	0.6138	0.1136	-0.0338	0.5945
v18	-0.0178	0.6065	0.3066	0.2388	0.4808
v76	-0.062	0.6032	0.2085	0.083	0.582
v63	0.1493	0.5937	0.0185	0.2817	0.5455
v72	0.1085	0.5937	0.0092	-0.0997	0.6257
v62	0.3271	0.5908	-0.012	-0.0321	0.5428
v102	0.163	0.5389	0.1358	0.0865	0.6571
v90	0.3755	0.5153	-0.0016	-0.0075	0.5934
v19	0.1003	0.5076	0.1723	0.3139	0.6041
v83	0.0486	0.4837	0.3864	0.119	0.6002
v65	0.2125	0.4219	-0.2351	0.4111	0.5526
v31	0.1989	0.3586	-0.0033	0.3381	0.7175
v94	0.005	0.3306	0.0201	0.2177	0.8429
v66	0.2977	0.315	0.301	0.1168	0.7079
v13	-0.2283	0.0029	0.7012	-0.0291	0.4553
v14	-0.2781	0.0579	0.6937	-0.0012	0.4381
v10	-0.2033	0.1567	0.6781	0.0295	0.4734
v12	-0.2227	-0.01	0.6689	0.0132	0.5027
v9	-0.2394	0.0627	0.6621	0.0087	0.5003
v82	-0.3378	0.0202	0.659	0.0371	0.4498
v11	-0.0649	0.1943	0.6571	0.057	0.523
v101	-0.3575	0.0724	0.6243	0.1336	0.4594
v55	0.0767	0.1299	0.6015	0.082	0.6087
v97	-0.4096	-0.0136	0.6	0.0055	0.472
v104	-0.2103	0.0994	0.5595	0.1472	0.6112
v99	-0.3924	0.1782	0.5459	0.0595	0.5127
v25	0.022	0.2311	0.524	0.0608	0.6678
v44	0.2579	0.0088	0.512	0.1837	0.6375
v43	0.0757	0.0409	0.4903	0.1862	0.7175
v7	0.2886	-0.0375	0.437	-0.003	0.7243
v47	0.3674	-0.0223	0.4177	0.3192	0.5881
v84	0.0151	0.3339	0.4096	0.027	0.7198
v26	0.3423	0.0942	0.4034	0.0857	0.7039
v17	0.1374	0.1642	0.347	0.1421	0.8136
v37	0.3093	0.0677	0.3336	0.2807	0.7096
v21	0.2881	0.2773	0.3182	-0.0166	0.7386
v58	0.2696	-0.2124	0.3146	0.2168	0.7362
v54	0.2481	0.0369	0.3139	0.172	0.809
v39	0.0465	0.0821	0.0184	0.7379	0.4462
v38	0.1683	0.0643	0.126	0.6811	0.4878
v22	-0.008	0.1661	-0.0803	0.6769	0.5078
v57	0.1202	0.2407	0.0339	0.6757	0.4699
v34	0.1621	-0.0709	0.1214	0.6688	0.5066
v33	0.1823	-0.0361	0.1974	0.667	0.4817
v41	0.2499	0.1234	-0.0776	0.6509	0.4926
v53	0.3389	0.0208	0.0934	0.6253	0.4851
v35	0.1371	-0.0724	0.1701	0.5372	0.6584

v46	0.0646	0.3611	-0.0001	0.537	0.5771
v51	0.1442	0.1914	0.3056	0.5119	0.5871
v30	0.2341	-0.0003	0.1612	0.4801	0.6887
v56	0.4044	0.126	-0.0052	0.4773	0.5928
v40	0.0676	0.4557	0.1382	0.4646	0.5528
v28	0.2425	0.1479	0.2779	0.4196	0.6661
v36	0.0478	0.1381	0.3325	0.3814	0.7226
v68	-0.0338	0.2673	0.0713	0.3806	0.7774
v52	0.228	-0.0447	0.3325	0.3761	0.6941

Notes: This table shows based on principal component factors analysis for the survey ($N = 303$) the factor loadings matrix for four factors sorted by the highest loading and the factors from factor 1 to factor 5. Results are rounded to the fourth decimal place.

Table A.5: Linear regressions – individual factor influences on tax compliance with control results

VARIABLES	(1) TC1	(2) TC2	(3) TC3
Moral	0.17*** (0.01)	0.24*** (0.01)	0.14*** (0.01)
Monetary benefit	-0.00 (0.01)	-0.07*** (0.01)	-0.08*** (0.01)
Deterrence	-0.10*** (0.01)	-0.10*** (0.01)	-0.09*** (0.01)
Authority	-0.02** (0.01)	0.03*** (0.01)	-0.01 (0.01)
Male	0.15* (0.08)	0.19* (0.10)	-0.06 (0.11)
Age	-0.00 (0.00)	0.02*** (0.00)	0.01* (0.00)
Education (in years)	0.03*** (0.01)	0.04*** (0.01)	0.03* (0.01)
Employment	-0.11 (0.09)	0.03 (0.12)	0.04 (0.14)
Married	-0.16* (0.10)	-0.12 (0.13)	-0.02 (0.14)
Divorced/Widowed	-0.15 (0.15)	-0.16 (0.21)	-0.24 (0.23)
Other family status	0.06 (0.34)	-0.71 (0.45)	-0.40 (0.49)
Risk attitude	-0.23*** (0.02)	-0.05** (0.02)	-0.09*** (0.02)
Religiousness	-0.39*** (0.08)	0.14 (0.11)	-0.05 (0.12)
Net income	0.03 (0.03)	0.17*** (0.04)	0.04 (0.04)
Constant	7.12*** (0.30)	2.53*** (0.40)	5.26*** (0.44)
Observations	2,825	2,825	2,825
R-squared	0.33	0.27	0.14

Notes: In this table, based on the third, large-sampled online survey with real taxpayers ($N = 2,825$) results of three linear regression models are presented with TC1, TC2 and TC3 as dependent variables. The four factors and the control variables serve as independent variables. Results are rounded to the second decimal place. Standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table A.6: Calinski/Harabasz stopping rule

Calinski/Harabasz		
Number of clusters	Pseudo F (4 Factors)	Pseudo F (3 Factors)
2	1,183.02	1,183.02
3	1,060.08	1,060.04
4	935.41	936.68
5	865.16	867.15
6	836.17	833.91
7	832.12	831.89
8	721.48	782.94
9	751.70	745.14
10	725.30	719.32

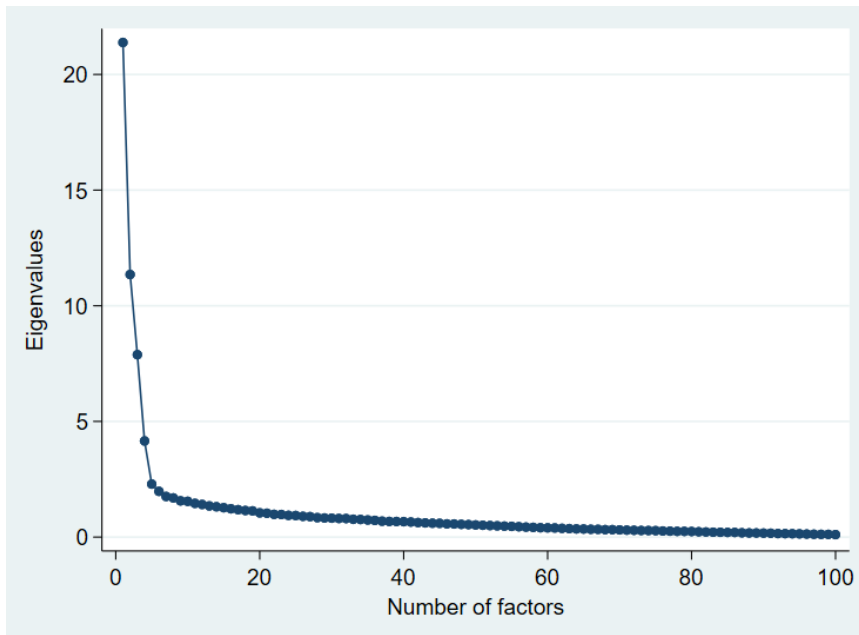
Notes: Results of the Calinski/Harabasz stopping rule are presented for the cluster analysis using the four factors morale, monetary benefit, deterrence and authority as well as the three factors morale, monetary benefit and deterrence. A high pseudo F value indicates a good suitability of the corresponding number of clusters. Results are rounded to the second decimal place.

Table A.7: Linear regressions – influence of clusters on tax compliance with control results

CLUSTERING	TCAI-16			TCAI-12		
	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	TC1	TC2	TC3	TC1	TC2	TC3
Rationalist	-1.56*** (0.08)	-1.73*** (0.11)	-1.48*** (0.11)	-1.75*** (0.08)	-1.93*** (0.11)	-1.49*** (0.11)
Male	0.03 (0.08)	0.03 (0.11)	-0.13 (0.12)	0.08 (0.08)	0.08 (0.11)	-0.10 (0.12)
Age	0.00 (0.00)	0.02*** (0.00)	0.01* (0.00)	0.00 (0.00)	0.02*** (0.00)	0.01* (0.00)
Education (in years)	0.04*** (0.01)	0.06*** (0.01)	0.03** (0.01)	0.04*** (0.01)	0.05*** (0.01)	0.03** (0.01)
Employment	-0.08 (0.10)	-0.02 (0.14)	0.00 (0.14)	-0.07 (0.10)	0.00 (0.13)	0.01 (0.14)
Married	-0.13 (0.10)	-0.08 (0.14)	-0.01 (0.14)	-0.11 (0.10)	-0.06 (0.14)	0.01 (0.14)
Divorced/Widowed	-0.15 (0.16)	-0.16 (0.23)	-0.24 (0.23)	-0.14 (0.16)	-0.16 (0.22)	-0.24 (0.23)
Other family status	0.12 (0.36)	-0.63 (0.49)	-0.35 (0.51)	0.08 (0.35)	-0.67 (0.49)	-0.36 (0.51)
Risk attitude	-0.27*** (0.02)	-0.11*** (0.02)	-0.14*** (0.02)	-0.26*** (0.02)	-0.10*** (0.02)	-0.13*** (0.02)
Religiousness	-0.39*** (0.08)	0.21* (0.12)	0.00 (0.12)	-0.39*** (0.08)	0.20* (0.12)	-0.00 (0.12)
Net income	0.06** (0.03)	0.22*** (0.04)	0.06 (0.04)	0.05* (0.03)	0.21*** (0.04)	0.05 (0.04)
Constant	9.35*** (0.23)	5.74*** (0.32)	6.04*** (0.33)	9.55*** (0.23)	5.96*** (0.31)	6.14*** (0.33)
Observations	2,825	2,825	2,825	2,825	2,825	2,825
R-squared	0.24	0.13	0.09	0.26	0.14	0.09

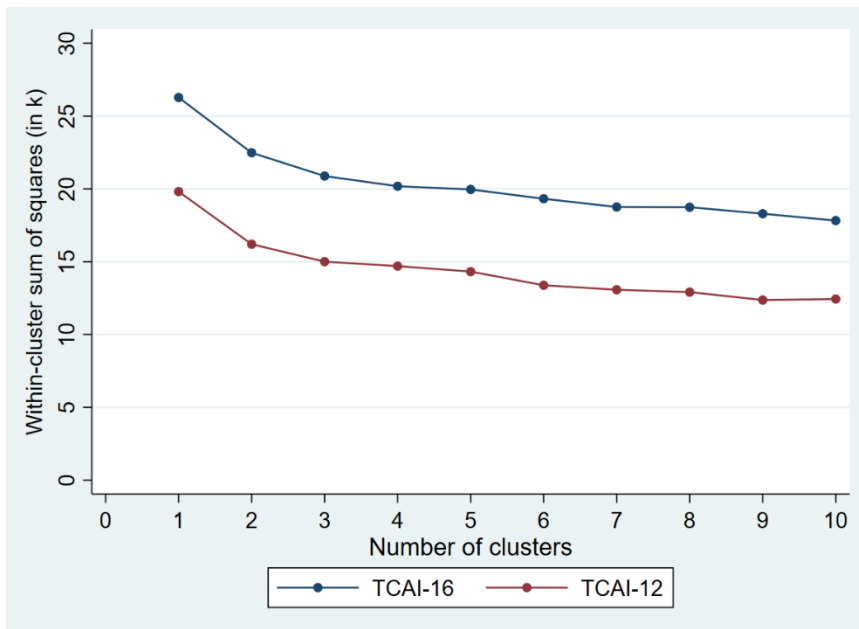
Notes: In this table, based on the third, large-sampled online survey with real taxpayers ($N = 2,825$) results of six linear regression models are presented with TC1, TC2 and TC3 as dependent variables. Rationalist is included as independent variable turning one for individuals in the rationalist cluster, zero otherwise. The moralist cluster is used as reference group. Additionally, control variables are included as independent variables. Results are rounded to the second decimal place. Standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Figure A.1: Scree plot for factor analysis



Notes: This figure shows results of the principal component factor analysis based on the survey ($N = 303$). Eigenvalues are plotted against the number of factors to identify the optimal number of factors using the elbow criterion.

Figure A.2: Scree plot using k-means clustering



Notes: This figure shows results of the k-means clustering based on data of the third, large-sampled online survey with real taxpayers ($N = 2,825$). The within-cluster sum of squares is plotted against the number of clusters to identify the optimal number of clusters using the elbow criterion. The upper graph depicts the clustering with the four factors morale, monetary benefit, deterrence and authority while the lower graph depicts the clustering with the three factors morale, monetary benefit and deterrence.

Appendix B

Upon analysis, it was observed that the monetary benefit factor does not demonstrate a statistically significant relationship with TC1. This finding is particularly notable in light of the clear significance associated with TC2 and TC3. A closer examination of the effects of other factors does not reveal discernible structural variations between the tax compliance variables. Thus, a further investigation into the relationship between monetary benefit and TC1 is warranted. Subsequent analyses highlighted potential interactions between the monetary benefit and deterrence factors. When deterrence is excluded from the regression model, the significance level for the monetary benefit factor notably shifted from 0.937 to less than 0.001. However, variance inflation factors did not indicate multicollinearity concerns, as all values were below 1.7, which is well below the commonly accepted critical threshold of 10.

The introduction of the interaction term “Monetary benefit * Deterrence” into the regression model yielded statistically significant outcomes for TC1, though this significance was not uniformly observed for TC2 and TC3. Detailed regression results are presented in *Table B.1*. Employing a spotlight analysis, as described and made popular by Aiken and West (1991), and treating both deterrence and monetary benefit as continuous variables, we assessed the influence of monetary benefit on TC1 across various levels of deterrence: one standard deviation below the mean, at the mean, and one standard deviation above the mean. To facilitate clearer interpretation, values for both variables were centered around their respective means.

Figure B.1 presents the findings. At lower levels of deterrence, monetary benefit exhibited the expected negative relationship with TC1 (p-value of 0.001). However, at average and high levels of deterrence, the relationship became positive (values of 0.064 for average deterrence and < 0.001 for high deterrence).¹ The significant negative effect and the counterpoising significant positive

¹ We also conduct a median split and a quartile split with the deterrence factor to investigate the relation between monetary benefit and TC1. As seen before coefficients are positive for high values of deterrence and negative for low values of deterrence.

effect statistically explain the overall insignificant effect of monetary benefit on TC1. We additionally conduct spotlight analysis for TC2 and TC3. The graphs can be seen in *Figures B.2* and *B.3*. In line with the regression results, findings show, independent of the deterrence value, exclusively negative coefficients with high significance values for monetary benefit.

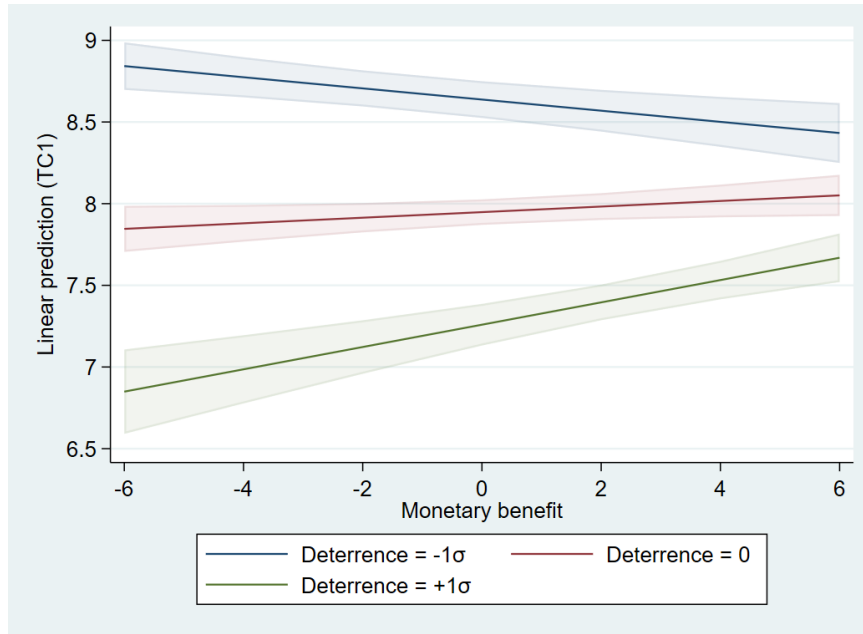
These results pose a conundrum. Given the consistent behavior of both the morale and deterrence factors across and within the tax compliance variables, it implies that individuals might perceive the salience of monetary benefit differently for TC1 in comparison to TC2 and TC3, particularly when deterrence is deemed significant. While this hypothesis is somewhat counter to conventional expectations, it remains a consideration in the analysis.

Table B.1: Linear regressions – individual factor influences on tax compliance with interaction term

VARIABLES	(1) TC1	(2) TC2	(3) TC3
Moral	0.17*** (0.01)	0.24*** (0.01)	0.14*** (0.01)
Monetary benefit	-0.08*** (0.02)	-0.06*** (0.02)	-0.04* (0.02)
Deterrence	-0.28*** (0.03)	-0.07* (0.04)	-0.01 (0.04)
Authority	-0.02** (0.01)	0.03*** (0.01)	-0.01 (0.01)
Monetary Benefit * Deterrence	0.01*** (0.00)	-0.00 (0.00)	-0.00* (0.00)
Male	0.16** (0.08)	0.18* (0.10)	-0.07 (0.11)
Age	-0.00 (0.00)	0.02*** (0.00)	0.01* (0.00)
Education (in years)	0.03*** (0.01)	0.04*** (0.01)	0.03* (0.01)
Employment	-0.10 (0.09)	0.03 (0.12)	0.03 (0.14)
Married	-0.14 (0.10)	-0.12 (0.13)	-0.03 (0.14)
Divorced/Widowed	-0.15 (0.15)	-0.16 (0.21)	-0.24 (0.23)
Other family status	-0.01 (0.33)	-0.70 (0.45)	-0.37 (0.49)
Risk attitude	-0.23*** (0.02)	-0.05** (0.02)	-0.09*** (0.02)
Religiousness	-0.38*** (0.08)	0.14 (0.11)	-0.06 (0.12)
Net income	0.02 (0.03)	0.17*** (0.04)	0.04 (0.04)
Constant	8.78*** (0.40)	2.26*** (0.55)	4.50*** (0.59)
Observations	2,825	2,825	2,825
R-squared	0.34	0.27	0.14

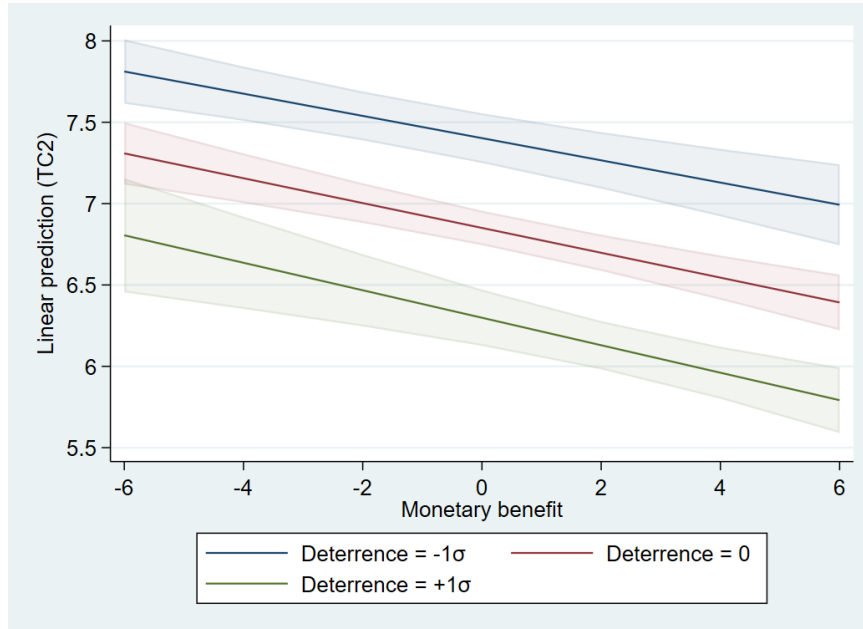
Notes: In this table, based on the third, large-sampled online survey with real taxpayers ($N = 2,825$) results of three linear regression models are presented with TC1, TC2 and TC3 as dependent variables. The four factors, an interaction term and the control variables serve as independent variables. Results are rounded to the second decimal place. Standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Figure B.1: Spotlight analysis using TC1



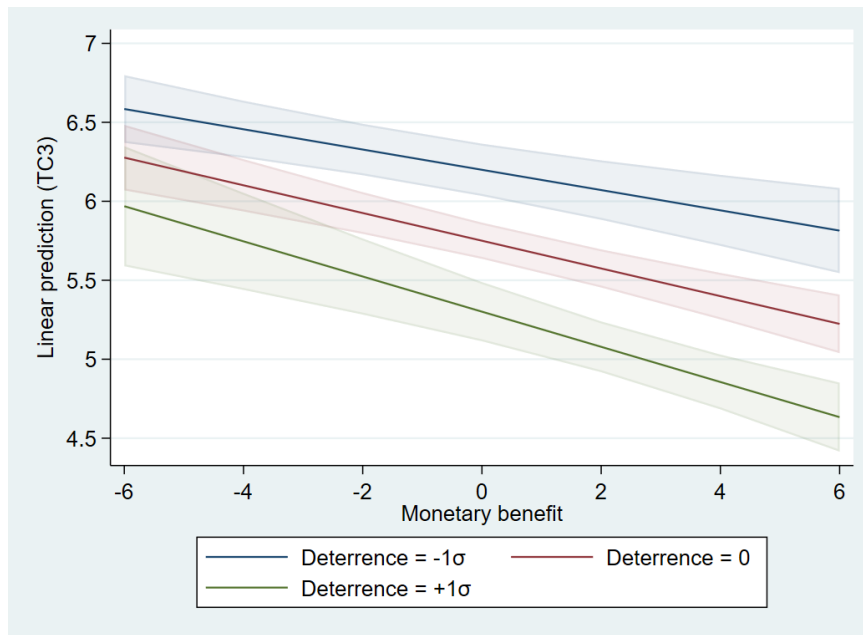
Notes: Conducted spotlight analysis showing the relation between tax compliance behavior (TC1) and the importance of the monetary benefit factor, moderated by the importance of the deterrence factor at the mean, one standard deviation above the mean and one standard deviation below the mean. Results are shown with 95% confidence levels.

Figure B.2: Spotlight analysis using TC2



Notes: Conducted spotlight analysis showing the relation between tax compliance behavior and the importance of the monetary benefit factor, moderated by the importance of the deterrence factor at the mean, one standard deviation above the mean and one standard deviation below the mean. Results are shown with 95% confidence levels.

Figure B.3: Spotlight analysis using TC3



Notes: Conducted spotlight analysis showing the relation between tax compliance behavior and the importance of the monetary benefit factor, moderated by the importance of the deterrence factor at the mean, one standard deviation above the mean and one standard deviation below the mean. Results are shown with 95% confidence levels.

Appendix C

To check robustness of the results in front of an incentivized background a classic tax evasion game is carried out. This *incentivized online experiment with real taxpayers* ($N = 334$) was conducted in Germany. Each individual received an initial endowment of 5 EUR which had to be taxed with a tax rate of 50%. Participants were informed that they are free to decide between two options: First, they could declare the full income of 5 EUR. Second, they could declare an income of 0 EUR. Moreover, information about the audit probability being 30% and about the penalty for caught evaders being 5 EUR were provided. As remuneration participants received the money they earned in the game and a show-up fee of 2.50 EUR. Next to demographics, each individual was faced with the TCAI-16. Some descriptive sample statistics are displayed in *Table A.1*. To conduct regression analyses two dependent variables are included. First, *TCIExp* being the same variable as TC1 and asking about the agreement with tax cheating. Second, *TCExp* as a binary variable turning one for individuals declaring their income and zero otherwise.

A linear regression model using TC1Exp and a logistic regression model using TCExp are carried out. Including control variables, results can be seen in *Table C.1*. The higher the importance of morale (deterrence) questions at the tax compliance decision the more (less) tax compliant individuals behave. For authority we do not find any significant results.² Thus, all findings remain as seen before except: (1) The effect around monetary benefit for TC1Exp does not include any interaction with the deterrence factor but, in line with the results for TC2 and TC3, shows a significantly negative coefficient and (2) the effect around monetary benefit for TCExp does not include any interaction with the deterrence factor, but in contrast to the results before, has no significant influence.

² We would lose 6 observations when controlling for *other family status* as it predicts success perfectly. Thus we exclude this control. However, results are robust when including this variable.

Table C.1: Logistic and linear regression – individual factor influences on experiment tax compliance
with control results

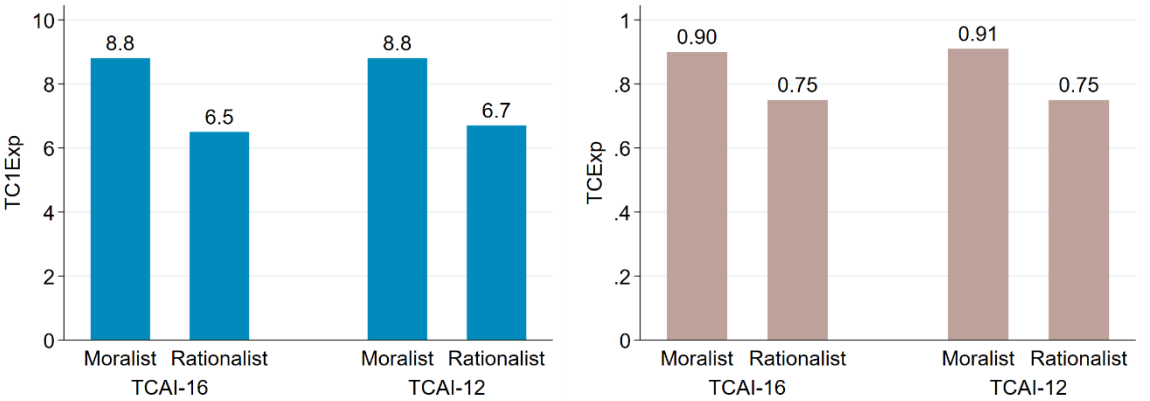
VARIABLES	(1) TC1Exp	(2) TCExp
Moral	0.2426*** (0.0292)	0.2472*** (0.0534)
Monetary benefit	-0.0632** (0.0257)	0.0146 (0.0516)
Deterrence	-0.1128*** (0.0216)	-0.0864** (0.0398)
Authority	-0.0111 (0.0235)	-0.0625 (0.0470)
Male	0.1538 (0.2168)	-0.1982 (0.3848)
Age	-0.0028 (0.0096)	0.0230 (0.0166)
Education (in years)	0.0159 (0.0302)	-0.0097 (0.0513)
Employment	-0.0135 (0.2466)	0.7024 (0.4447)
Married	-0.0094 (0.2876)	-0.3893 (0.5025)
Divorced/Widowed	0.1000 (0.3293)	-0.4398 (0.5910)
Other family status	-0.3232 (0.7878)	
Risk attitude	-0.2342*** (0.0442)	-0.1198 (0.0780)
Religiousness	-0.1638 (0.2197)	1.3284*** (0.4430)
Net income	0.0523 (0.0871)	0.1803 (0.1640)
Constant	6.3943*** (1.0065)	-2.6369 (1.7122)
Observations	334	334
R-squared	0.4501	
Pseudo R-squared		0.2487

Notes: In this table, based on the incentivized online experiment with real taxpayers ($N = 334$) results of a linear regression model using TC1Exp as dependent variable and a logistic regression model using TCExp as dependent variable are presented. The four factors and the control variables serve as independent variables. The independent variable “other family status” is excluded in the logistic regression as it predicts success perfectly. Results are rounded to the fourth decimal place. Standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Appendix D

A detailed description of the incentivized online experiment with real taxpayers ($N = 334$) can be seen in appendix C. When analyzing tax compliance behavior some descriptive statistics in *Figure D.1* offer first implications. For both cluster solutions and tax compliance variables, moralists show higher values than rationalists.

Figure D.1: Descriptive statistics – mean experiment tax compliance values in the different clusters



Notes: In this figure the mean values for TC1Exp and TCExp using TCAI-16 and TCAI-12 are presented based on the incentivized online experiment data with real taxpayers ($N = 334$). Values are rounded to the first or second decimal place.

To check performance of the data classification we conduct regression analyses. Results are displayed in *Table D.1*. As dependent variables we use in a linear regression model TC1Exp and in a logistic regression model TCExp. As independent variables we use the dummy variable *Rationalist* and the control variables. Observing results similar as in section 5.1.1 would strengthen applicability of our findings. Indeed, coefficients point in the same direction on a constantly high significance level. Overall being a rationalist compared to being a moralist has a clearly negative influence on tax compliance.

Table D.1: Logistic and linear regressions – influence of experiment clusters on tax compliance

CLUSTERING	TCAI-16		TCAI-12	
	(1)	(2)	(3)	(4)
VARIABLES	TC1Exp	TCExp	TC1Exp	TCExp
Rationalist	-1.97*** (0.25)	-1.17*** (0.34)	-1.85*** (0.24)	-1.33*** (0.34)
Constant	9.40*** (0.81)	0.79 (1.13)	9.53*** (0.82)	0.97 (1.13)
Observations	334	334	334	334
R-squared	0.30		0.30	
Pseudo R-squared		0.13		0.14
Controls	YES	YES	YES	YES

Notes: In this table, based on the incentivized online experiment data with real taxpayers ($N = 334$) results of two linear regression models using TC1Exp as dependent variable and two logistic regression models using TCExp as dependent variable are presented. Models (1) and (2) are based on the TCAI-16, while models (3) and (4) are based on the TCAI-12. Rationalist is included as independent variable turning one for individuals in the rationalist cluster, zero otherwise. The moralist cluster is used as reference group. Included controls are gender, age, education, employment status, family status, risk preference, religiousness and income. The independent variable “other family status” is excluded in the logistic regression as it predicts success perfectly. All values are rounded to the second decimal place. Standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

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