

# The Impact of Tax Knowledge and Budget Spending Influence on Tax Compliance \*

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## Abstract

We conduct a computerized economic laboratory experiment to infer the causal effect of two non-economic determinants on tax compliance. We find strong evidence that higher compliance in tax systems with low power of authorities can be achieved by increasing trust in authorities in form of knowledge about tax expenditures and the possibility for taxpayers to actively influence budget spending. However, in tax systems with high power of authorities we do not find any effect due to the threatening impact of high audit rates already enforcing a high level of compliance. To clearly identify the importance of these effects on tax compliance we take account of how the power of authorities is perceived by taxpayers when making decisions under risk and uncertainty in reporting tax liability. The perceived power of authorities is measured by taxpayer's individual risk attitudes. Further, we control for taxpayer's general attitude towards paying taxes and the overall orientation towards tax authorities via the motivational posture "tax commitment" (Braithwaite 2003). Individual risk aversion as elicited by lottery choices in a multiple price list format is correlated with tax compliance, reflecting the acknowledgement of the power of tax authorities. Opposed to this we do not find any evidence that a positive orientation towards tax authorities is positively related to compliance.

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PsycINFO: 2300, 2900, 3000, 4200

Keywords: tax evasion, tax compliance real effort, tax knowledge, budget spending, tax commitment, risk, experimental economics

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## **1. Introduction**

The present paper contributes to the more recent tax evasion literature going beyond the traditional framework by Allingham and Sandmo (1972). As empirical evidence clearly suggests determinants of individual tax compliance behavior cannot be solely reduced to mere economic factors. Implying that tax payers' decision to evade taxes is only based on the associated expected benefits in saving money and the expected costs in getting caught and being punished with fines falls short to empirically explain observed rates of tax compliance in various institutional settings. Additionally, non-economic concepts like educating tax payers about tax laws, providing them with helpful information about the tax system, involving them actively in political processes about government spending are found to be useful policies that culminate in higher trust in tax authorities, conveying to increased tax compliance as well. Field studies in Switzerland for example report higher tax compliance and tax morale in regions where citizens can actively vote for budget spending (Pommerehne/Weck-Hannemann 1996, Feld/Frey 2002, Torgler 2005). Similarly, there is empirical support that tax knowledge accounts for a positive orientation towards the tax system (Vogel 1974), improves fairness perceptions and tax ethics (Song/Yarbrough 1978, Wartick 1994, Eriksen/Fallan 1996, Palil/Mustapha 2011) and increases tax compliance if tax payers are given information about negative effects of tax evasion, sanctions and fines (Schwartz/Orleans 1967, Park/Hyun 2003).

The present study augments this domain of the tax literature by investigating firstly how tax knowledge about public expenditures and, secondly, tax payer's influence on budget spending affects tax compliance. By this our paper will not only provide a first attempt to disentangle the effects of tax knowledge and the possibility to express preferences about budget spending on tax compliance but also suggest easy to implement avenues for tax authorities to increase tax compliance.

We employ this form of tax knowledge and the possibility for tax payers to actively decide about budget spending as proxies for trust in authorities. We use a computerized economic laboratory experiment to examine the relationship between trust and compliance in two tax systems with varying power of authorities. By changing the institutional environment in a controlled way a systematic investigation about the interplay between power of and trust in authorities can be achieved and their effect on tax compliance disentangled. Our experimental design follows the standards in the recent literature (Boylan/Sprinkle 2001, Alm et al. 2010, Heinemann/Kocher 2010). As a measure to increase external validity the entire experiment is

explicitly framed in a tax context. Participants determine their endowment in a first income phase with their individual achievement in a “slider task” (Gill/Prowse 2009). As investigated in the experimental literature, legitimate assets produce rational behavior (Cherry/Frykblom/Shogren 2002). In the context of decisions under risk and uncertainty, earned income aligns decisions more closely to the participants’ true preferences compared to endowed income (van Dijk/Sonnemans/van Winden 2001, Gneezy 2003). The importance of effort and aspirations on tax evasion has also been shown in experimental settings by Boylan and Sprinkle (2001) and Kirchler et al. (2009).

In a second tax-reporting phase participants then decide which amount of their income they report as taxable income. The underlying tax system is hereby hypothetical. The treatments are designed in the following way: In the Knowledge-treatment participants are informed for what specific purposes the hypothetical government spends the collected tax money for. Precisely, participants are shown a list of specific items of expenditures and are told that government spends the tax revenue equally among them. Thus, budget spending becomes clearly transparent. Going one step further, we conduct an additional treatment where participants are not only informed about tax expenditures but have additionally the right to decide themselves for what items they want their taxes to be spend for. Thus, participants are given the opportunity to spend their money on hypothetical public goods that are best aligned to their own preferences. We interpret this form of fiscal exchange between government and tax payer as an even trust worthier relationship compared with the purely knowledge setting. Lastly in the control treatment participants are asked to report their taxable income without having any information about the tax system and the possibility to actively influence any budget spending.

Further, to clearly identify the impact of trust in authorities on tax compliance it is important to control for the individual perception of the power of and generally the overall orientation towards tax authorities. We measure the power of authorities by the participant’s risk attitudes as they identify the threatening effect of audit probabilities and fines. By measuring the participant’s motivational posture “tax commitment” using a scale suggested by Braithwaite (2003) we identify the individual’s moral obligation in paying taxes in general and the overall orientation towards the tax authority.

In the next section, we give a brief review of literature on tax knowledge and participation. In section 3 we introduce our hypotheses. The experimental design and procedure is described in section 4. Our results are presented in section 5 and section 6 concludes.

## 2. Related Literature

Extensive research in the tax literature characterizing tax compliance as individual decision making under risk and uncertainty was devoted to the standard economic model by Allingham and Sandmo (1972). The aim in the first place was to empirically validate the four crucial parts of the model, specifically the effect of income, tax rate, audit probability and penalty rate on tax compliance (see for a recent review Kirchler et al. 2007). However, as most of these studies point out, this model only partly predicts taxpayer's behavior (see for example Alm/Jackson/McKee. 1992, Alm/McClelland/Schulze 1992, Andreoni et al. 1998, Anderhub et al. 2001, Frey/Feld 2002, Frey/Torgler 2007, Kirchler et al. 2007). Determinants not included in the model seem to have a significant impact whether to comply or not.

Kirchler, Hoelzl and Wahl (2008) suggest the “slippery slope” framework. In this framework tax compliance does not only depend on the legitimate power tax authorities are equipped with by auditing tax files, imposing penalties etc. but also on trust taxpayers assign to them. The orthogonal dimensions of power on the one hand and trust on the other hand span hereby the plane of all possible levels of tax compliance. Increasing (decreasing) one dimension holding the other dimension fixed will contribute to higher (lower) compliance. If both dimensions are only poorly realized, a minimum of compliance will result. In tax systems with low trust in tax authorities, high compliance can be induced by providing tax authorities with extensive power. On the other hand, if the power of authorities remains on a relatively low level, higher compliance can be accomplished by creating a climate between tax payers and tax authorities that is characterized by high trust.

Various field studies and laboratory experiments shed light on how this climate of trust can be effectuated. Of particular interest in the context of the present study is the influence of tax knowledge and participation on tax compliance<sup>1</sup>.

Tax knowledge describes the individual's subjective knowledge of a tax system and its function (Kirchler/Hoelzl/Wahl 2008). In an early work Schwartz and Orleans (1968) investigated how knowledge about sanctions and fines of a tax system affects tax compliance. Using a survey with a sample of 273 American tax payers they find that giving information to tax payers about possible sanctions in case of evading taxes deters and leads to an increase in tax compliance. This result corresponds to the experimental study of Park and Hyun (2003)

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<sup>1</sup> For further determinants that enhance trust in authorities see Kirchler et al. 2007 and Palil/Mustapha 2011.

who find that informing tax payers about the negative consequences of tax evasion appeals to social norms and encourages tax compliance. Similar results are provided by Holler et al. (2008). In their experimental study, giving information about the benefits of paying taxes or giving negative information about the consequences of evading taxes affect tax behavior if the information campaign is aligned with the taxpayer's regulatory focus. If aligned correctly tax compliance was found to increase significantly. Vogel (1974) concludes in his field study with Swedish tax payers that knowledge about tax laws creates a deeper understanding of the benefits in paying taxes that is necessary to enhance compliant behavior. This result is in line with the study by Eriksen and Fallan (1996). They conduct a quasi-experiment and analyze the influence of tax knowledge on attitude of tax fairness. The authors divided business students into two groups, one group with a study focus on marketing (control group) and the other one with a focus on taxation (experimental group). Eriksen and Fallan find no difference in attitude towards taxation when the two groups had the same background knowledge concerning taxes in the first year, while showing significant evidence that students in the experimental group tend to have a higher perception towards the fairness of taxation compared to the control group due to courses focusing on tax issues in the second year. Overall, the authors find a positive and strong correlation between tax knowledge and theoretical tax compliance. A similar study was carried out by Tan and Chin-Fatt (2007) with a student sample from New Zealand. Using pre-testing and post-testing about fairness perception of the New Zealand tax system they challenge the result of Eriksen and Fallan as students with a focus on taxation and elevated knowledge about tax laws did not significantly indicate a more pronounced perception about fairness and tax compliance attitudes compared to students who did not take any courses about taxation. In a survey by Collins, Milliron and Toy (1992) with 700 households in the US no correlation between tax knowledge and tax compliance was found. Here, the questionnaire asked about tax knowledge that included several parts of the tax system such as knowledge about tax laws, penalties and fines. The authors explain their results with the fact that their sample population is skewed towards the highly educated population who on average might be more likely to admit noncompliance.

Another promising way of affecting tax compliance is based on participation which refers to the degree of influence citizens have on governmental institutions by actively taking part in the political process. It is closely related to what the literature defines as direct democracy (Frey/Feld 2002, Kirchgässner 2010). The impact of participation on tax compliance and tax morale that is defined as the willingness or the moral obligation to pay taxes (Torgler 2005)

was mainly analyzed by using real world observations from Switzerland. Switzerland is thereby a favored example, because the Swiss Cantons have different constitutions ranging from representative democracy to strong direct democratic structures that allow for testing hypotheses of direct democracy on tax evasion (Kirchgässner 2010). Pommerehne and Weck-Hannemann (1996) for example use data of 25 Swiss Cantons and show that in Cantons with direct control over governmental budgets, taxes are less evaded than in Cantons where citizens have less participation rights. The authors explain the results with the satisfaction citizens have in these Cantons due to the provision of public goods funded by taxes that meet their demands more closely. Frey (1997) argues that participation in form of initiatives, referenda or meetings leads to higher tax morale. According to his “Crowding Theory” this climate enhances the intrinsic motivation of citizens to conform to their civil duty in paying taxes. Using cross sectional and time series data from 26 Swiss Cantons he finds support for his hypothesis, as in Cantons with direct democracy the “average amount of income concealed is about CHF 1600 (per taxpayer) less than the mean income concealed in all cantons” (Frey 1997). Further, tax morale is significantly lower in Cantons with representative democracy.

Experimental literature on the concept of voice that focuses more on voting procedures and how outcomes are established in groups supports the findings of the field studies described above. Alm, Jackson and McKee (1993) conduct a public good experiment with groups of 5 where each subject individually receives income and then decides how much to provide for the underlying public good. The authors find that contribution is much higher if subjects are able to vote for the public good that is funded by their taxes. Similarly, under the majority rule high compliance is achieved when there is strong preference in the group for one specific public good. Wahl, Muehlbacher and Kirchler (2010) also argue that high contribution results when the public good for which citizens vote, is congruent with their own preferences. They conduct several treatments of a public good experiment and show that voting in relation with a public good that is favored by the majority of the group yields the highest contribution compared to the alternative treatments.

Our contribution differs from the studies described above in the following way:

We set up a purely hypothetical tax system which consists of tax items that can be found in the budget plan of the 14 German federal ministries. From each federal ministry we

incorporate the corresponding tax item with the highest allocated budget of the fiscal year 2009.

The tax system is completely transparent as taxpayers receive information about all hypothetical public expenditures. Taxpayers are told that the hypothetical government spends all of the collected tax money for these items on an equal basis. We regard the transparency of the tax system by unraveling information about budget spending as a signal of trust to the taxpayer. To the knowledge of the authors, this is the first study that investigates the impact of tax knowledge regarding concrete tax expenditures on tax compliance.

In addition to that, other than examining mechanisms how outcomes are produced in a group to assure higher compliance we investigate how tax payers behave if they can decide individually upon budget spending that comes closely to their own preferences. We take the political system of a representative democracy as given and augment it by offering taxpayers the possibility to actively participate within the scope of this system. Specifically, in our setting taxpayers work for their money and pay their tax duty individually without prior communication or negotiating with others, thus, no voting procedures and potential influence from other group members are at place. We regard this fiscal exchange between government and taxpayer as even trust worthier relationship as government spends money for public goods that are closely aligned to the individual taxpayer's preferences.

The study of Li et al. (2011) regarding taxpayers' potential influence on budget spending is closest related to ours. They conduct an experiment to investigate the effect of donations to governmental institutions that are designated for specific purposes. In their setting subjects receive an endowment of 20.00\$ and are free to decide how much of this money they want to donate to a real organization differing in type (governmental agency vs. private charity), level (national, state, local) and function (Cancer Research, Disaster Relief, Education Enhancement, Parks and Wildlife). Subjects repeat this allocation process 12 times, so that every decision consists of allocating their endowment between themselves and a real organization that is chosen at random. At the end of the experiment, one decision is chosen randomly for payoff and the corresponding share to the organization whether governmental or private is afterwards truly donated. The authors show that donations to private charities are significantly higher than donations to governmental agencies; however, they still receive on average donations of 22% of the endowment. Hence, the results suggest that taxpayers are also willing to pay voluntary taxes especially if they know about and can decide for which specific purpose their donation is going to be used for.

### 3. Hypotheses

Our hypotheses are derived upon the literature discussed above. We regard two tax systems, one with low and one with high power of authorities. The power of authorities is implemented by changing the audit probability to a low or a high rate. For each tax system we gradually increase trust in authorities in form of tax knowledge about public expenditures and taxpayer's influence on budget spending. By doing so, we are able to investigate to what degree trust has to be established within each tax system to have an effect on taxpayer's behavior. When power is low evading taxes gets more attractive for taxpayers as authorities lack the resources to legitimately enforce compliance and, as such, the expected punishment is at a minimum. However, according to the "slippery slope" framework by Kirchler, Hoelzl and Wahl (2008) higher compliance can still be reached on a voluntary basis as a result of a relationship between taxpayers and authorities that is characterized by high trust. Our first hypothesis is therefore:

*H1: Tax compliance increases with the degree of trust in tax systems with low power of authorities*

In tax systems with high power of authorities we expect that compliance is already enforced on an elevated level by high audit rates so that enhancing trust in authorities will not result in even higher compliance, yielding:

*H2: A high degree of enforcement leads to high tax compliance (irrespective of the degree of trust in the tax system)*

Further, to identify any effect of trust in form of tax knowledge and influence on budget spending on tax compliance, it is important to disentangle those effects from 1) an overall positive orientation of the taxpayer towards the tax authority in general and from 2) tax compliance that is efficiently enforced by the tax authorities. An overall positive orientation towards the tax authority for example can be rooted in the belief that the tax system is desirable or that the tax authority has the legitimate power to impose taxes. In these cases paying taxes is accepted to be of important use which is responded by high compliance. Enhancing trust in tax authorities will therefore not result in even higher compliance as taxable income will be reported truthfully in any situation. On the contrary, if taxpayers have

doubts about the intentions of tax authorities and feel not being treated fairly or respectfully an overall negative orientation towards tax authorities evolves leading to tax avoidance or tax evasion. To control for this, we measure taxpayers' orientation towards tax authorities by the motivational posture "tax commitment" (Braithwaite 2003) and come up with the following hypothesis:

*H3: A higher degree of an overall positive orientation towards the tax authority leads taxpayers to higher tax compliance*

Lastly, as paying taxes is a decision under risk and uncertainty the taxpayer's attitude towards risk is a further aspect that must be accounted for. This measure is used to address the question how the threat of audits and fines by the tax authority is subjectively perceived. Referring to the traditional framework by Allingham and Sandmo (1972), a stronger perception of this threat adds more concavity to the taxpayer's utility function where the expected penalty might now outweigh the expected benefits to evade taxes, thus leading to higher tax compliance. To evaluate the perceived power of tax authorities we measure individual risk preferences by using a lottery in a multiple price list format as successfully employed by Holt and Laury (2002) and Goeree, Holt and Palfrey (2003). Our last hypothesis is as followed:

*H4: A higher degree of risk aversion leads taxpayers to higher tax compliance*

In the next section we describe our experimental design and procedure along with the parameters used in the experiment.

#### **4. Experimental Design and Procedure**

##### *Experimental Design*

Our experiment follows a 2x3 design where we vary parameters along the authority's power and trust dimension. We construct two hypothetical tax systems, one with high power and the other one with low power of authorities. For each of these two tax systems we gradually increase trust in authorities by employing three different treatments.

Each treatment consists of two phases, only differing with respect to the second phase. In the first phase subjects individually work for their income in the slider task (Gill and Prowse

2009), see Figure A1 in the appendix. For each slider that is correctly positioned by dragging the button of the slider with the computer-mouse from the starting position of 0 to the value of 50 a constant amount of the experimental currency “Taler” is added to the subject’s current income. The working phase lasts for 120 seconds, followed by the second phase in which subjects state what amount from zero up to their earned income they want to declare for their tax report. In this phase we implement the treatments as followed: in the Knowledge treatment (K) subjects are informed about all public tax expenditures of the hypothetical tax system. Specifically, subjects see a list of all tax items that constitute the hypothetical tax system on their computer screen and on the written instructions (see Figure A2 in the appendix). Further, they are told that the hypothetical government will spend all the collected tax money equally on the hypothetical tax items. In the next treatment (BS) subjects can actively influence the budget spending. They receive exactly the same list of tax items but are allowed to decide themselves for what item of expenditure their taxes should be allocated to. Subjects are free to choose also more than one tax item or none of the tax items at all. The third treatment is the control treatment (Con) where subjects only report tax liability and do not get any information about the tax system or the opportunity to decide about budget spending. Irrespective of the treatment, the tax report is audited in the tax system with high power of authorities with a preannounced probability of 0.25 and with an audit probability of 0.1 in the tax system with low power. In both tax systems underreporting tax liability engenders a penalty amounting to the difference between the true and the declared income. In all treatments, the two phases are repeated three times, so that as soon as all decisions in the second phase are made, a new period begins, starting again with the working phase. Further, to avoid strategic behavior in subsequent periods as response to previous audit outcomes, subjects learn about whether they were detected in any period in case of underreporting only after all three reports are sent to the tax authority. Consequently, subjects are first informed about the payoffs they received in each period at the end of the experiment. This auditing procedure is communicated to all subjects before the start of the experiment and is therefore common knowledge.

### Experimental Procedure

The experiment was conducted in May 2011 and January 2012 at the Business and Economic Research Laboratory (BaER-Lab) at the University of Paderborn and computerized using the software z-Tree (Fischbacher 2007). For each of the two tax systems with high and low audit probability we ran two sessions of the K, BS and Con treatments respectively. Subjects were

recruited by the online recruiting system ORSEE (Greiner 2004) and were only allowed to participate in one session. In the tax system with low (high) audit probability 52 (56) subjects participated in the BS treatment, whereas 54 (55) subjects participated in the K and 54 (55) in the Con treatment respectively. After each subject was seated randomly to a computer workplace in a cubicle detached from each other, all subjects received the same introductory talk and were told not to communicate during the session. Instructions were then distributed and time for a careful reading was granted. After that, an example was given with numbers collected before the participants knew anything about the experiment, to make sure that everybody understood the rules of the game. In line with existing experimental works in the tax literature, instructions were framed in a tax context (see for example Boylan/Sprinkle 2001 and Alm et al 2010), using terms like tax, tax authority, tax report, tax base etc. Prior to the first working phase subjects practiced on the 48 sliders for 120 seconds to assure subjects get used to the slider task beforehand.

In the working phase, subjects earned their income by working on 48 sliders for 120 seconds and receiving 1500 Taler for each correctly positioned slider. Then, in the second phase, any fraction of this earned income could be declared as a tax base for the tax report. In both tax systems we set the tax rate at 30 %. If an underreported tax file was detected the difference between the true value of the earned income and the income declared as the tax base was subtracted from the subject's earnings in this period. All rates and the audit probability were held constant across periods and across treatments within the same tax system. The tax items of the hypothetical tax system used in the K and BS treatment were taken from the federal budget across the 14 federal ministries in Germany and attached to the instructions. To be more specific, for each federal ministry we identified the item with the highest tax expenditure in the fiscal year 2009, and placed this item with the exact wording on our tax list<sup>2</sup> (see Table A3 in the appendix). This setting has two main advantages: Firstly, items are included that are found in reality thus enhancing tax context, and secondly, as each federal ministry is represented exactly once bias towards taxes for a particular purpose is minimized. The payoffs in each period were summed up and exchanged to Euro with a rate of 7500 Taler per Euro. On top of this, subjects received a show-up fee of 2.50 €. After the final payoff results were displayed at the end of the experiment subjects were asked to answer a questionnaire that was divided into two parts, whereas in the first part, risk preferences were elicited using an incentivized ten-paired lottery choice framework, followed by an unpaid

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<sup>2</sup> Two additional options „Other“ and „Neutral“ were placed on the list just in case the items listed were not of special importance for the subject.

second part, where tax commitment was measured with an eight item scale along with questions on the socio-economic background of the participants like age, gender etc.. Each session lasted for about one hour and fifteen minutes, subjects earned on average roughly 13 €.

Although there are no payoff spill-overs between periods and feedback about the period outcomes are given at the end of the experiment rendering the decisions in each period of a treatment independently, the decisions of a subject might be driven by the same motivational postures. Therefore, we treat every subject as one independent observation, thus collecting in total 326 independent observations.

## **5. Results**

In the following section we present our experimental results. We start by providing overall summary statistics. Then we present the results of non-parametric tests based on individual data to investigate whether knowledge about tax expenditures and taxpayer's influence on budget spending has an effect on tax compliance. For this, we compare the average compliance rate as the ratio of declared income in the tax-reporting phase to the actual income earned in the working phase between the treatments within each tax system. Subsequently, robustness checks will be made by relating these results to further aspects discussed in the tax literature like the possible impact of income on tax compliance and the level of effort subjects exert during the slider task. Lastly, regression analysis is used to support the results.

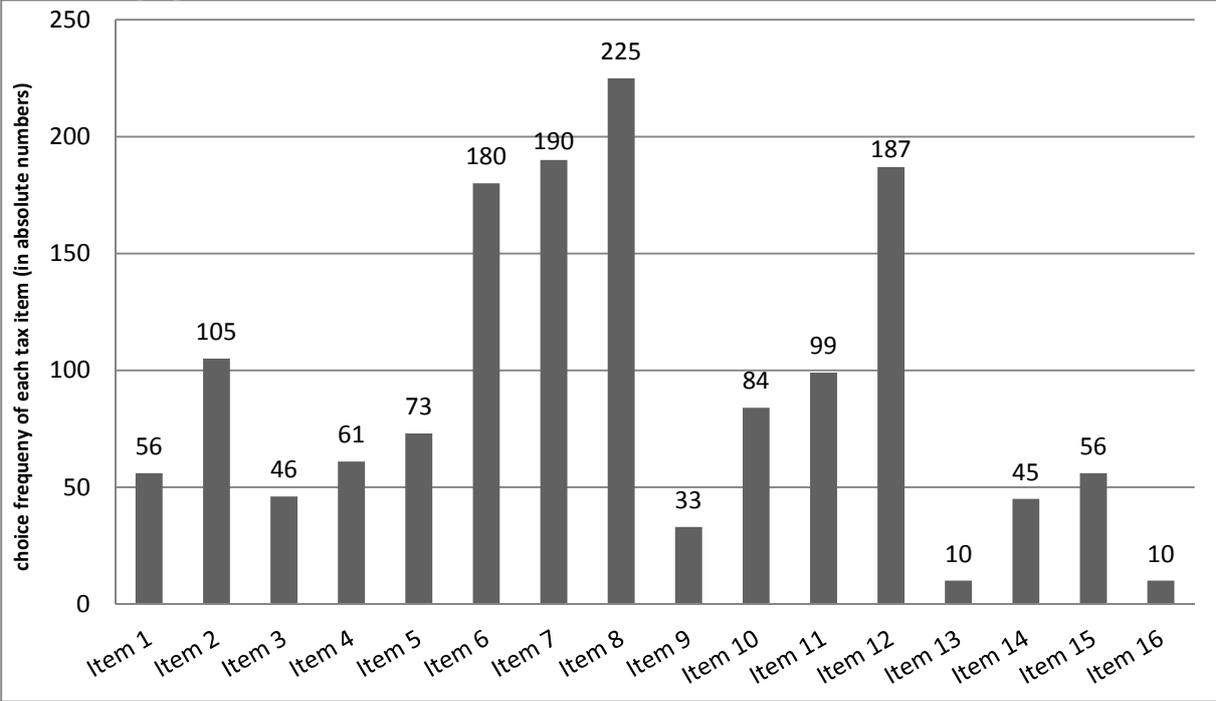
### *Summary Statistics*

From the 326 subjects who participated in one of the treatments the major part studied economics and business administration. 47.24% of the subjects were male, 52.76% female. Subjects were on average 22.57 years old (sd.dev.:5.45). The major fraction of subjects did not make a tax return in real life yet. Across all treatments and tax systems 61 subjects truthfully reported tax liability in each period. 265 subjects reported at least one time less taxable income and among them 18 subjects reported zero in every period.

Figure 1 shows the distribution of the tax items chosen during the BS treatments of both tax systems with high and low power of authorities. On average subjects chose in each period 4.5 tax items when reporting their taxable income. The most prominent items with a choice frequency of well above 100 were mainly social services (Items 8 and 12), budget for

regenerative energy (Item 7) and innovation/high-tech research (Item 6). As only a very tiny fraction of subjects chose no tax items at all (Item 16), the distribution clearly shows that subjects make strong use of the items offered to them indicating subject’s willingness to participate in the tax system.

Figure 1: Aggregated distribution of items chosen in the BS treatments of tax systems with low and high power of authorities



Item 1	Bilateral financial agreements
Item 2	Federal police
Item 3	Business administration of the German federal customs authority
Item 4	German patent office
Item 5	German federal railway
Item 6	Innovation and high-tech research
Item 7	Advancement for selective projects that make use of renewable energy
Item 8	State services for families
Item 9	Social insurance contributions and national assistance for soldiers
Item 10	Lump-sum reimbursement of the expenses of health insurances for services concerning the whole society
Item 11	Maintenance of the culture relationship with foreign countries
Item 12	Social Insurance
Item 13	Advancement for coal mining
Item 14	Governmental grant for farmers’ old-age insurance
Item 15	Other
Item 16	Neutral

*Compliance rate across treatments within each tax systems (H1, H2)*

Table 1 and Figure 2 show the average compliance rates for each treatment in the tax systems with low and high power of authorities respectively. Referring to compliance rates in the low power case we find strong evidence that on average subjects comply more in the BS treatment than in the Con treatment (Mann Whitney U-Test,  $z=2.205$ ,  $p=0.014$  (one-tailed)). This difference in compliance also holds between the K and the Con treatment, as though this difference is only weakly significant (Mann Whitney U-Test,  $z=1.360$ ,  $p=0.087$  (one-tailed)). To evaluate the increasing effect of trust in tax authorities in form of tax knowledge, and, on top of this, with taxpayer's influence about budget spending on tax compliance, we apply a Jonckheere-Terpstra Test for ordered alternatives. We reject clearly the null hypothesis that with higher degree of trust in the tax system there is no effect on compliance rates (Jonckheere-Terpstra, J-T value (standardized) = 2.185,  $p=0.015$  (one-tailed)). Thus, our hypothesis (H1) is strongly supported that tax compliance increases with the degree of trust with low power of authorities.

Opposed to these results, in tax systems with high power of authorities we do not find any significant difference in compliance rates, neither between treatments BS and Con nor between K and Con, where compliance rates in Con is even higher than in the K treatment (Mann Whitney U-Test,  $z=0.143$ ,  $p=0.444$  (one-tailed);  $z=0.08$ ,  $p=0.938$  (one-tailed)). Also, we cannot reject the null hypothesis that compliance does not change with higher trust in authorities by tax knowledge and the possibility for taxpayers to actively decide upon budget spending (Jonckheere-Terpstra, J-T value (standardized) = 0.110,  $p=0.462$  (one-tailed)). Thus, our second hypothesis (H2) finds support that high audit rates already enforce a high level of compliance diminishing the effect of trust in authorities to statistically zero. Remarkably, although an increase in the audit probability raises tax compliance in each treatment in tax system with high power of authorities compared to their equivalents in the low audit case, this difference is not significant for the BS and K treatments (Mann Whitney U-Test,  $z=0.664$ ,  $p=0.255$  (one-tailed);  $z=0.30$ ,  $p=0.489$  (one-tailed)). Consistent with empirical findings, only in the Con treatment where the usual tax reporting procedure takes place higher audit probabilities causes tax compliance to rise significantly (Mann Whitney U-Test,  $z=2.383$ ,  $p=0.008$  (one-tailed)).

### *Tax commitment and tax compliance (H3)*

To control for taxpayer's orientation towards tax authorities, we measure the motivational posture "tax commitment" by the eight statements suggested by Braithwaite (2003) and include these questions into a self-reporting questionnaire at the end of the experiment to avoid any manipulation with the decisions in the experiment (see for the eight statements Table A4 in the appendix). Respondents express their degree of agreement with the single statements on a scale from 1 (representing strong disagreement) to 5 (representing strong agreement). We follow Braithwaite and calculate for each subject a commitment index by adding up the rating for all eight statements and dividing it by the number of statements.<sup>3</sup>

A principal component analysis in fact shows that all items strongly load to one factor with a similar weight. Accordingly, we construct the commitment index by the equally weighted contribution of each factor. With regards to our hypothesis H3 we would expect to find a positive correlation between commitment to the tax system and compliance. However, when pooling the observations overall and of those treatments tax systems with low and high power of authorities separately, we do not find any evidence to reject the null hypothesis of no correlation between the commitment index and tax compliance (Spearman's rho (overall): -0.01,  $p=0.41$ ; Spearman's rho (low tax system):0.0978,  $p=0.11$ ; Spearman's rho (high tax system):0.007,  $p=0.46$ ). Using a Jonckheere-Terpstra Test to examine whether the commitment index is equally distributed across all treatments within the same tax system we see that there is evidence on a weak significant basis that the commitment index differs in the treatments of tax system with high power (Jonckheere-Terpstra, J-T value (standardized) = -1.788,  $p=0.074$  (two-tailed)). However, looking at each of these treatments separately we do not find a single case where commitment is positively related to tax compliance implying that the decision with respect to compliance is independent of one's orientation towards the tax authorities (Treatment P Spearman's rho: 0.0194,  $p=0.45$ ; Treatment K Spearman's rho:-0.11,  $p=0.22$ ; Treatment Con Spearman's rho: 0.13,  $p=0.17$ ). The treatments in the tax system with low power do not significantly differ with regard to tax commitment (Jonckheere-Terpstra, J-T value (standardized) = 0.475,  $p=0.635$  (two-tailed)).

In summary, we interpret our findings that the overall positive orientation towards tax authorities measured in our experiment by the motivational posture "tax commitment" does not correlate with tax compliance, neither when we look at the overall sample nor in each

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<sup>3</sup> In fact, a principal component analysis clearly suggested one factor by applying the Kaiser's criterion. All our analyses are robust to replacing the index by an index which is calculated by weighting each statement by its unrotated factor loading.

single tax system. Therefore we reject hypothesis H3 and infer that our results with respect to compliance cannot be ascribed by the subjects' orientation towards tax authorities.

*Risk attitude and tax compliance (H4)*

We measure risk attitudes by using the binary lottery framework of Holt and Laury (2002), In this design subjects decide between two lotteries A and B, as shown in Table 2. Lottery A yields an outcome of 10 € with a probability  $p$  and an outcome of 8 € with a probability  $(1-p)$ . Accordingly, Lottery B provides an outcome of 19.25 € with the same probability  $p$  and 0.50 € with the probability  $(1-p)$ .

Table 2  
Binary lottery framework to measure risk attitude

Round	Lottery A		Lottery B		Expected payoff difference*
	$p$	$(1-p)$	$p$	$(1-p)$	
1)	0.1 of 10 €	0.9 of 8 €	0.1 of 19.25 €	0.9 of 0.50 €	5.83 €
2)	0.2 of 10 €	0.8 of 8 €	0.2 of 19.25 €	0.8 of 0.50 €	4.15 €
3)	0.3 of 10 €	0.7 of 8 €	0.3 of 19.25 €	0.7 of 0.50 €	2.48 €
4)	0.4 of 10 €	0.6 of 8 €	0.4 of 19.25 €	0.6 of 0.50 €	0.80 €
5)	0.5 of 10 €	0.5 of 8 €	0.5 of 19.25 €	0.5 of 0.50 €	-0.88 €
6)	0.6 of 10 €	0.4 of 8 €	0.6 of 19.25 €	0.4 of 0.50 €	-2.55 €
7)	0.7 of 10 €	0.3 of 8 €	0.7 of 19.25 €	0.3 of 0.50 €	-4.23 €
8)	0.8 of 10 €	0.2 of 8 €	0.8 of 19.25 €	0.2 of 0.50 €	-5.90 €
9)	0.9 of 10 €	0.1 of 8 €	0.9 of 19.25 €	0.1 of 0.50 €	-7.58 €
10)	1.0 of 10 €	0.0 of 8 €	1.0 of 19.25 €	0.0 of 0.50 €	-9.25 €

\*The difference in expected payoffs was not shown to subjects.

Regarding the differences in outcomes for each of the two lotteries we speak of lottery A as being “safer” than lottery B. The probability  $p$  increases across the decisions in steps of 0.1 so that obtaining the higher outcome in each lottery becomes more likely. Therefore, the expected payoffs change over the course of decisions, so it is assumed that risk neutral agents choose lottery A exactly four times before switching once and for all to lottery B. Similarly, switching before (after) that point speaks for more risk-seeking (more risk-averse) agents. The switching point thus defines a threshold  $p^*$  where the following holds: for  $p < p^*$  lottery A and for  $p > p^*$  lottery B is chosen. There is a range of possible values which  $p^*$  can take that satisfies the condition above, because  $p$  is not continuous but instead increases in discrete steps of 0.1. Following Holt and Laury (2002) and Goeree, Holt and Palfrey (2003) we replace the notion of expected payoffs with expected utilities and use the utility function

$U(x) = x^{1-r}$  where  $x$  is the monetary payoff from the lottery and  $r$  a non-negative coefficient that represents agent's constant relative risk aversion (CRRA).

The individual risk preferences are then determined by calculating the curvature of the underlying utility function using the switching point in the lottery to estimate the coefficient.<sup>4</sup> Subjects were asked to make their decisions for the lottery part after each session. Four subjects were afterwards selected at random to get paid for one randomly drawn row of the lottery table and the received outcome was added to the subject's present earnings. Table 3 shows at which decision lines of the lottery framework subjects switched once from lottery A to lottery B. Overall, 32 subjects who switched more than once between the lotteries were excluded from the analysis as their choice pattern indicated no clear crossover.

Table 3  
Switching points of the subjects in the lottery framework

Switching Point from Lottery A to Lottery B	High Power			Low Power			Total
	K	BS	Con	K	BS	Con	
Line 1	1	-	-	-	-	-	1
Line 2	-	-	-	-	-	-	-
Line 3	3	-	-	1	1	-	5
Line 4	3	2	4	2	3	6	20
Line 5	5	16	6	10	8	8	53
Line 6	14	4	7	6	6	5	42
Line 7	8	6	11	7	12	6	50
Line 8	9	8	12	9	11	15	64
Line 9	1	6	6	4	8	5	30
Line 10	1	2	2	-	1	2	8
Never Switched	4	6	2	2	-	2	16
<b>Total</b>	<b>49</b>	<b>50</b>	<b>50</b>	<b>41</b>	<b>50</b>	<b>49</b>	<b>289</b>

Notes: K: Knowledge treatment, BS: Budget Spending treatment, Con: Control treatment

To analyze the impact of risk preferences on the decisions in the tax experiment we sort the subjects into four risk types ranging from risk loving (category 1) to risk averse (category 4). With a switching point earlier than decision line five subjects are grouped into category 1, subjects switching in decision line 5 from lottery A to lottery B are assigned to category 2 which represents the risk neutral type. Subjects who switch in decision line 6 are classified as being slightly risk averse (category 3) and finally subjects having a switching point beyond

<sup>4</sup> Details on the derivation of the individual risk preferences can be found in the appendix.

decision line 6 are characterized as being risk averse (category 4). 5 subjects who started with Lottery B in decision line 1 and switched once to lottery A in decision line 4 were classified as being risk loving and therefore grouped in category 1. Table 4 shows the corresponding distribution of our sorting procedure.

Table 4  
Distribution of risk categories

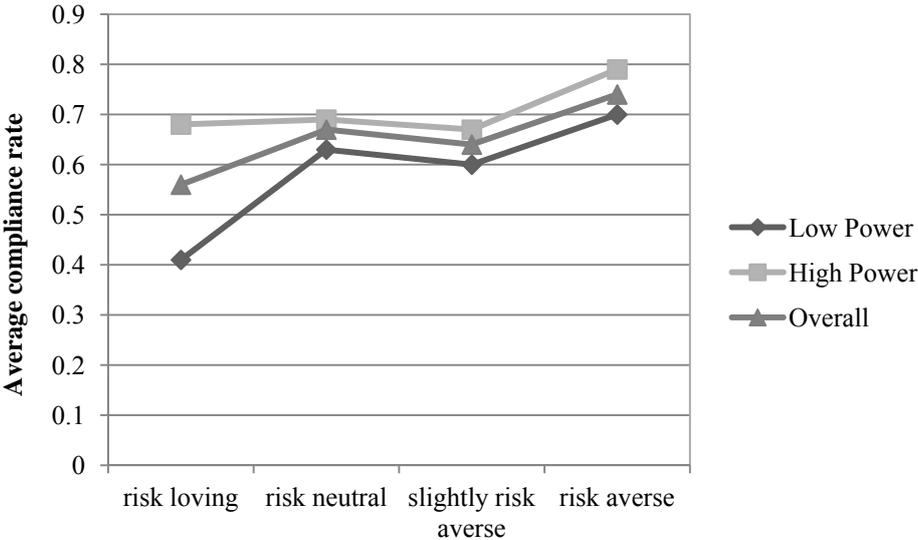
Risk category	# of subjects	r-coefficient
Risk loving	31 (11%)	-0.382
Risk neutral	53 (18%)	0.014
Slightly risk averse	42 (14%)	0.282
Risk averse	168 (57%)	0.898

Applying maximum likelihood analysis to the binary lottery choices we capture the degree of risk aversion for each risk category by estimating the r coefficient via the switching point (see Table 4)<sup>5</sup>. The r-values are consistent with the literature, as the coefficient increases with higher risk aversion, obtaining a value smaller than 0 for the risk loving type and a value close to one for the risk averse type (Holt/Laury 2002, Goeree/Holt/Palfrey 2003). Also notice that the r-value of each risk category falls exactly in intervals that were used in the literature to match subjects successfully with their corresponding risk attitude, so we have strong support that our sorting procedure is correct. Turning to hypothesis H4 we find for the overall sample as well as for each single tax system, that compliance rises significantly with greater risk aversion (Jonckheere-Terpstra, (overall) J-T (standardized) = 2.942, p=0.0016 (one-tailed); (tax system with low power of authorities) J-T (standardized) = 2.04, p=0.02 (one-tailed); (tax system with high power of authorities) J-T (standardized) = 2.38, p=0.0086 (one-tailed)), thus, we find strong support for H4. Figure 3 shows the results graphically. If we reconsider our previous results about the effect of increasing trust in authorities on the observed compliance rates in both tax systems, we have to control that within each tax system the risk groups are similarly distributed across the single treatments. Looking at the risk distribution in each single tax system, we do not find any evidence that a certain risk group is more present in one treatment compared to the other (Jonckheere-Terpstra, (tax system with high power of authorities) J-T (standardized) = 0.464, p=0.639 (two-tailed); (tax system with low power of authorities) J-T (standardized) = 1.430, p=0.153 (two-tailed)). Hence, as our treatments in

<sup>5</sup> Detailed results on the r-coefficients and compliance rates across all treatments and risk categories can be found in the appendix.

both tax systems are similar with respect to risk profiles, we have strong support that in the tax system with low power of authorities higher compliance is indeed due to an increase in trust induced by tax knowledge and the influence on budget spending while in the tax system with high power of authorities the elevated power of authorities outshines any effect associated with trust by taking compliance through high audit rates already to a high level.

Figure 3  
Compliance rates across all risk categories



*Robustness of the Results*

As indicated in the related literature section there is empirical evidence that income has an impact on tax compliance although the direction of influence is not clear. Further, as subjects work on the slider task to earn their income, it is important to investigate whether this exerted effort somehow influences the decision in the tax reporting phase. In the experimental study by Boylan and Sprinkle (2001) for example tax compliance rises significantly when subjects have to work for their taxable income instead of just being endowed with money from the experimenter. Kirchler et al. (2009) found evidence that when subjects exert high effort on the task the earned income is not put at risk that easily, so taxes are less evaded. Therefore we reflect on our previous results and investigate whether income and level of exerted effort affect subject’s behavior in any way.

### *Income and tax compliance*

To investigate whether the compliance pattern in our experiment is associated to a certain type of income level, we define three income groups (Low, Average, High). Subjects who earned on average equal or less than 97500 Taler in the slider task were assigned to the low group, those who earned between 97500 Taler and 114000 were put in the average group, and lastly the high group consisted of subjects earning more than 114000 Talers. Figure 4 shows the average compliance rates in the three different income groups for each treatment and tax system. Analyzing the complete dataset across all tax systems and treatments we do not find any evidence that income is somehow related to tax compliance (Jonckheere-Terpstra, J-T value (standardized) = 1.000,  $p=0.317$  (two-tailed)). This result holds also for each tax system (Jonckheere-Terpstra, J-T value (standardized) = 0.901,  $p=0.367$  (two-tailed); J-T value (standardized) = 0.887,  $p=0.375$  (two-tailed)), and we find no support for a significant relationship between income and compliance either in any of the single treatments. Thus, we conclude that in our experiment income is not related to compliance by any means.

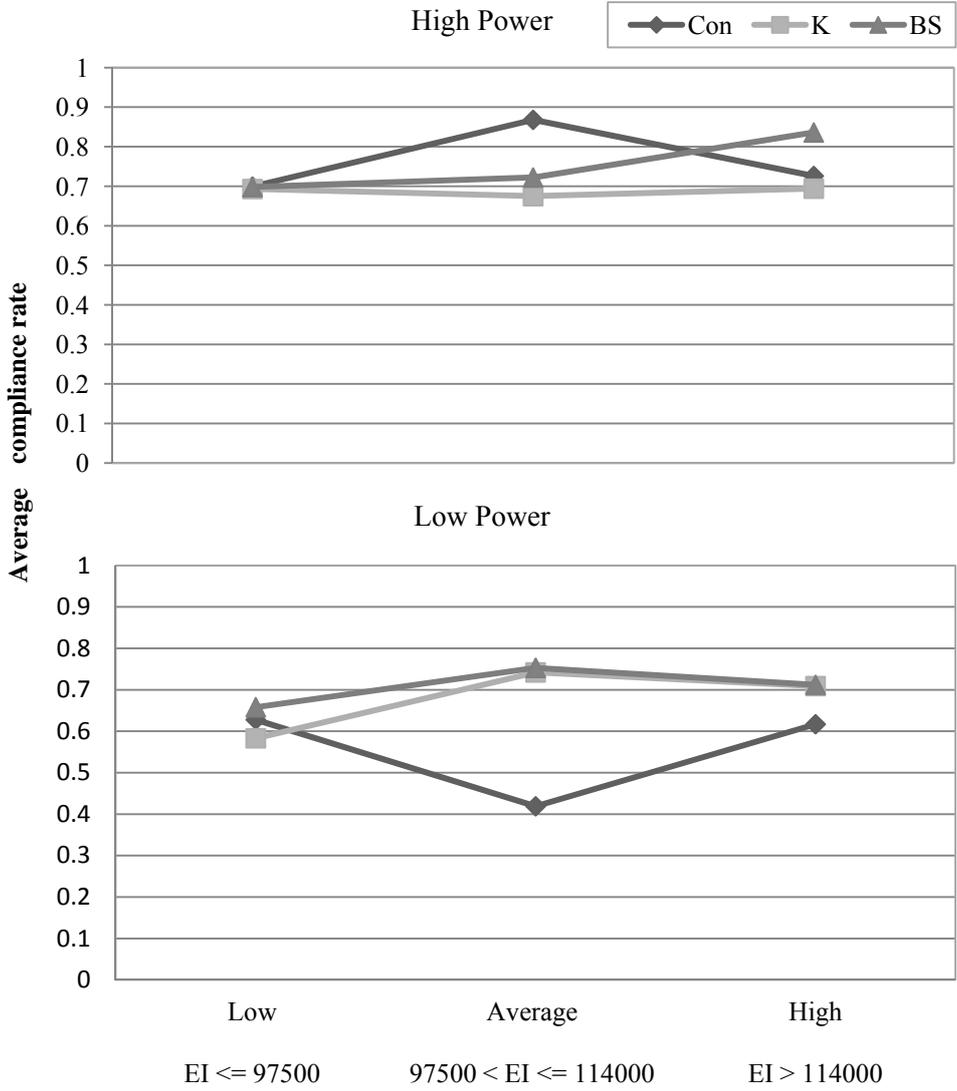
### *Exerted effort and tax compliance*

We test the potential impact of effort on tax compliance by using for each pair of periods the difference in subject's incomes as a measure of change in exerted effort. If there is a significant increase in income from one period to the other we assume that relatively more effort was exerted to achieve this higher income level, and, the other way around, we assume relatively lower effort exerted if income decreased from one period to the other.

Table 5 shows the average income earned in each period overall and separated for each tax system. When comparing all the paid periods pair-wise in the overall dataset and for each tax system individually, we find that the level of income increases significantly from the former to the later period indicating that relatively more effort was always exerted from the previous to the subsequent period. However, using the non-parametric Wilcoxon-Test for matched groups, we observe only in one case (tax system with low power of authorities, period 1 vs. period 3) a significant change in compliance, in all other cases we do not find any support that speaks for a relationship between effort and compliance, neither overall nor in each single tax system (Table 6). Therefore, we can infer that in our experiment exerted effort on the task and tax compliance are not related to each other.

Figure 4

Average compliances rate across different income groups and different treatments in the tax systems with high and low power of authorities (EI=Earned Income)



Notes: K: Knowledge treatment, BS: Budget Spending treatment, Con: Control treatment

Table 5

Average income earned in each period (in experimental currency Talers, standard deviation in brackets)

	Period 1	Period 2	Period 3
Overall	33782.21 (8384.06)	35291.41 (8578.29)	36349.69 (8621.38)
Tax system with low power	35062.50 (7172.57)	36309.38 (7165.36)	37293.75 (7308.86)
Tax system with high power	32548.19 (9260.57)	34310.24 (9669.31)	35439.76 (9655.55)

Table 6

Average change in compliance between all possible pairs of periods (z-statistics of non-parametric Wilcoxon Test for matched groups and p-values in brackets)

	Period 1 vs. Period 2	Period 1 vs. Period 3	Period 2 vs. Period 3
Overall	-0.01 (0.75, p=0.45)	-0.0076 (1.22, p=0.22)	0.029 (0.16, p=0.87)
Tax system with low power	0.03 (1.55, p=0.12)	-0.037 (1.98, p=0.04)	-0.004 (-0.47, p=0.63)
Tax system with high power	-0.01 (-0.50, p=0.61)	0.02 (-0.29, p=0.77)	0.0097 (0.67, p=0.50)

### *Regression analysis*

In this section we provide regression analysis on the experimental data to support our findings and to investigate further determinants on tax compliance not discussed in the previous analysis so far. Firstly, we use as a benchmark a standard OLS model, with the average compliance rate as dependant variable.

As shown in Table 7, the first specification in column (1) contains variables to revisit the predictions of the first two hypotheses. These variables include the level of trust in authorities (the experimental treatments Knowledge, Budget spending and Control) and the power of authorities (Low versus High). We use Knowledge, Budget spending and Low as dummy variables, thus omitting the variables Control and High. We add subject characteristics such as age, gender and whether subjects filed a tax form in reality before (Tax experience). We also control for income that was totally earned over the three periods by the numbers of sliders that were positioned correctly. We interact the level of trust in and the power of authorities to capture the effect of tax knowledge and budget spending on tax compliance (Low\*Knowledge, Low\*Budget spending). Column (2) controls for the subject's orientation

towards tax authorities by using the individual commitment index derived from the subject's responses to the motivational posture statements. Finally, Column (3) incorporates the individual risk preferences by adding dummy variables for the risk types risk neutral, slightly risk averse and risk averse. The risk type risk loving serves as reference category.

Table 7  
Average Compliance Rate (OLS Model, robust standard errors)

	(1)	(2)	(3)
Dependent Variable			
<i>Average Compliance Rate</i>			
Knowledge	-0.046 (0.057)	-0.049 (0.057)	-0.058 (0.058)
Budget spending	0.004 (0.057)	-0.003 (0.056)	-0.025 (0.056)
Low	-0.195*** (0.069)	-0.251*** (0.076)	-0.252***(0.077)
Income (total)	0.006 (0.005)	0.006 (0.005)	0.002 (0.005)
Age	0.006** (0.003)	0.006** (0.003)	0.007** (0.003)
Female	0.031 (0.370)	0.040 (0.038)	0.046 (0.038)
Tax experience	0.049 (0.038)	0.047 (0.039)	0.035 (0.040)
Low * Knowledge	0.181** (0.091)	0.191** (0.090)	0.211** (0.094)
Low* Budget spending	0.174* (0.089)	0.186** (0.087)	0.188** (0.088)
Commitment		0.022 (0.016)	0.014 (0.016)
Risk neutral			0.058 (0.074)
Slightly risk-averse			0.033 (0.078)
Risk-averse			0.153** (0.060)
Constant	0.484*** (0.116)	0.412*** (0.128)	0.392*** (0.133)
R squared	0.067	0.074	0.105
Observations	326	326	294
Number of subjects	326	326	294

Notes: Dependent variable is the average compliance rate. Robust standard errors are in parentheses. Reference groups are Control, High and Risk loving

\* Significant at the 10% level.

\*\* Significant at the 5% level.

\*\*\* Significant at the 1% level.

The results in Table 7 are robust across specifications and consistent with the previous analysis. Trust in authorities in form of tax knowledge and deciding about budget spending increases compliance by 18.1% and 17.4% respectively in the tax system with low power of authorities, compared to the corresponding control treatment. When controlling for the subject's orientation towards tax authorities and risk attitude compliance rate is found to rise even more in these trust treatments. In neither specification trust in authorities affects compliance in the tax system with high power of authorities. Overall, low power of authorities leads to significant less compliance compared to the counterpart tax system with high power

of authorities. Taken these results together we see our hypotheses H1 and H2 additionally supported. Subject's orientation towards tax authorities has no effect on compliance, but risk attitude does as risk-averse subjects significantly report more taxable income than risk-loving subjects. Income, gender and tax experience do not influence compliant behavior. Age has a positive impact on compliance in each specification, however, the effect is rather small.

For robustness considerations we specify an alternative model. Based upon our experimental design the data constitutes a panel as each subject makes a decision in each period. Further, because no feedback between periods is given we employ pooled OLS regressions, with the single individual compliance rate per period as dependant variable. The explanatory variables remain as in the benchmark except for income that is now measured by the number of sliders correctly positioned per single period.

Table 8  
Compliance rate per period (Pooled OLS Model, standard errors clustered over subjects)

	(1)	(2)	(3)
Dependent Variable			
<b><i>Compliance Rate per period</i></b>			
Knowledge	-0.044 (0.057)	-0.048 (0.057)	-0.056 (0.057)
Budget spending	0.003 (0.056)	-0.004 (0.056)	-0.025 (0.055)
Low	-0.196*** (0.068)	-0.253*** (0.075)	-0.25***(0.076)
Income (per Period)	0.022* (0.013)	0.022* (0.013)	0.014 (0.012)
Age	0.006** (0.003)	0.006** (0.003)	0.007**(0.003)
Female	0.034 (0.037)	0.043 (0.038)	0.049 (0.038)
Tax experience	0.049 (0.038)	0.047 (0.038)	0.035 (0.039)
Low * Knowledge	0.180** (0.090)	0.190** (0.089)	0.209**(0.093)
Low* Budget spending	0.174** (0.088)	0.186** (0.086)	0.187**(0.087)
Commitment		0.022 (0.015)	0.014 (0.156)
Risk neutral			0.057 (0.073)
Slightly risk-averse			0.033 (0.077)
Risk-averse			0.152**(0.059)
Constant	0.458*** (0.109)	0.386*** (0.122)	0.359*** (0.127)
R squared	0.053	0.059	0.082
Observations	978	978	882
Number of subjects	326	326	294

Notes: Dependent variable is the compliance rate per period. Robust Standard errors are in parentheses. Reference groups are Con, High, and Risk loving.

\* Significant at the 10% level.

\*\* Significant at the 5% level.

\*\*\* Significant at the 1% level.

As shown in Table 8 the results stay qualitatively the same compared to the benchmark and almost do not vary in quantitative terms either. Only two exceptions can be seen. The increase in compliance by actively influencing budget spending in the tax system with low power of authorities is also in the first specification significant at the 5% level. The other exception concerns the income earned in each period. In the first two specifications there is a significantly positive effect on compliance. However, after we control for subject's orientation towards tax authorities along with risk attitude this statistical significance disappears.

## **6. Discussion and Conclusion**

In this present paper, we examine the potential impact of two non-economic concepts on tax compliance. In our experiment, tax knowledge about public expenditures and taxpayer's influence on budget spending are embedded in two hypothetical tax systems with respectively high and low power of authorities in order to investigate in what specific tax system trust in authorities is of major relevance. To clearly disentangle any effect from factors that are shown in the literature to influence tax compliance likewise, we control for tax commitment, risk attitude, income and effort exerted on the task in the experiment. We observe that enhancing trust in authorities by giving complete information about public expenditures of the tax system and in addition taxpayers the possibility to decide for what items their taxes are to be spend for leads to higher tax compliance in tax systems with low power of authorities. With high audit rates by powerful tax authorities in place, compliance does not change when trust in authorities is increased. Further, we controlled for various potential determinants other than trust in authorities to cover our results. By measuring the overall orientation towards tax authorities through the motivational posture "tax commitment" we made sure that observed compliance rates are not driven by orientations disproportionally in favor or opposed to tax authorities or general attitudes in paying taxes. We find that "tax commitment" and tax compliance are not related to each other, and thus, do not explain our results. As we determined subjects' risk attitude to measure how the power of authorities is perceived we found evidence that compliance increases with the degree of risk aversion. Additionally, all treatments in both tax systems with low and high power of authorities display similar risk profiles so that our main results are not affected by an uneven distribution of risk biasing compliance in a special direction. Factors like income or the level of effort that was exerted to perform the task are not related to compliance by any means. Our results have important

policy implications as obviously the mere hypothetical possibility to express preferences about budget spending influences tax compliance. Tax authorities can provide taxpayers along with the annual tax declaration information about the items, the volume of the federal budget and a feedback mechanism to express preferences about the allocation of tax spending. This is a realizable avenue for tax authorities to increase tax compliance. In contrast to approaches to implement more direct democracy by allowing voting about specific items of government spending the suggested low profile approach to express preference about tax spending is much easier to realize. However, further research need to investigate the robustness of the results with different mechanisms to express tax spending preferences and more heterogeneous subject groups.

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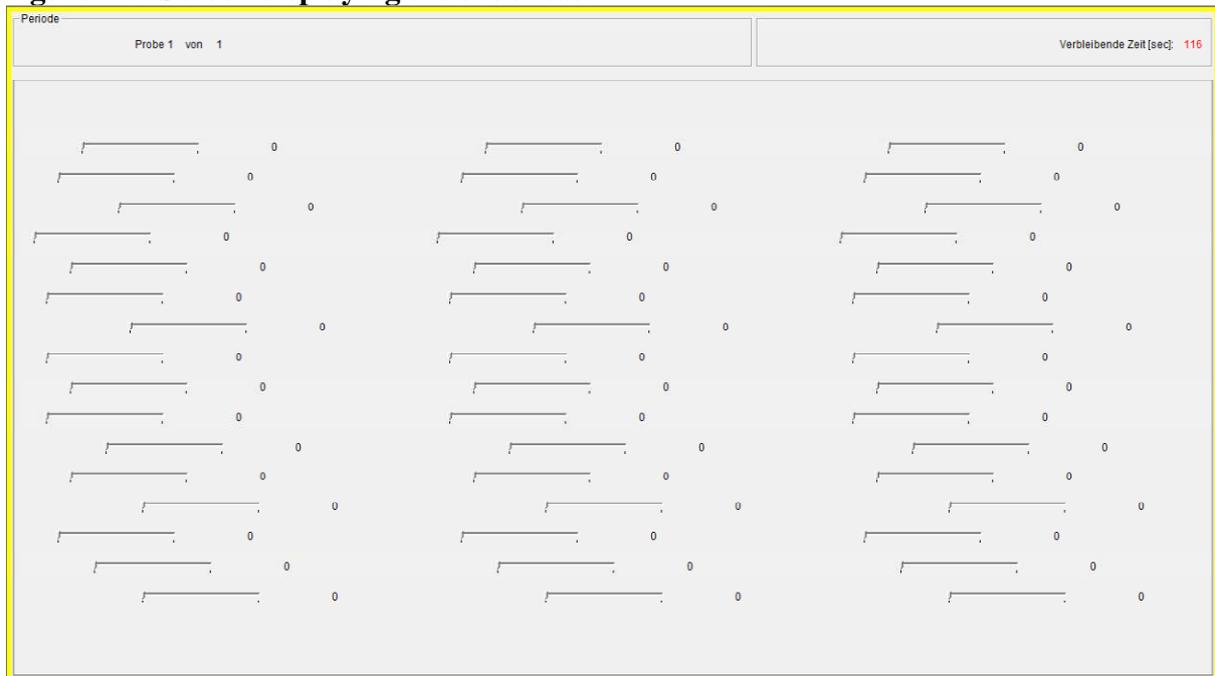
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## Appendix

**Figure A1: Screen displaying the slider task**



In every working phase subjects saw 48 sliders and had 120 seconds time to position as many of them correctly. For each correctly positioned slider on the value of 50 a certain amount was added to the subject's income.

**Figure A2: Split-screen in the tax-reporting phase**

Periode 1 von 3	
<b>Steuererklärung</b> Bitte füllen Sie nun Ihre Steuererklärung aus.	
<p><b>Optionsauswahl für die Steuerverwendung:</b></p> <p>Bitte treffen Sie Ihre Auswahl. Die zu zahlende Steuer wird anschließend für diese Option(en) verwendet. Mehrfachnennungen sind möglich.</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Bilaterale finanzielle Zusammenarbeit</li> <li><input type="checkbox"/> Bundespolizei</li> <li><input type="checkbox"/> Bundeszollverwaltung</li> <li><input type="checkbox"/> Deutsches Patent- und Markenamt</li> <li><input type="checkbox"/> Eisenbahnen des Bundes</li> <li><input type="checkbox"/> Forschung für Innovationen, Hightech-Strategie</li> <li><input type="checkbox"/> Förderung von Einzelmaßnahmen zur Nutzung erneuerbarer Energien</li> <li><input type="checkbox"/> Gesetzliche Leistungen für die Familie</li> <li><input type="checkbox"/> Kommandobehörden, Truppen, Sozialversicherungsbeiträge und Fürsorgemaßnahmen für Soldatinnen und Soldaten</li> <li><input type="checkbox"/> Pauschale Abgeltung der Aufwendungen der Krankenkassen für gesamtgesellschaftliche Aufgaben</li> <li><input type="checkbox"/> Pflege kultureller Beziehungen zum Ausland</li> <li><input type="checkbox"/> Sozialversicherung</li> <li><input type="checkbox"/> Zuschüsse zur Alterssicherung der Landwirte</li> <li><input type="checkbox"/> Zuschüsse für den Absatz deutscher Steinkohle zur Verstromung</li> <li><input type="checkbox"/> Andere Optionen</li> <li><input type="checkbox"/> Neutral/Unentschieden</li> </ul>	<p><b>Angabe der Bemessungsgrundlage:</b></p> <p>Bitte entscheiden Sie jetzt, wie viel Sie von Ihrem erarbeiteten Einkommen für Ihre Steuererklärung angeben möchten. Der von Ihnen angegebene Wert dient als Bemessungsgrundlage für Ihre Steuer. Sie können dabei einen Wert zwischen 0 und 3000 Taler angeben.</p> <p>Der Steuersatz beträgt 30%. Die zu zahlende Steuer berechnet sich anhand des von Ihnen eingegebenen Wertes. Ihre vorläufige Periodenauszahlung beträgt somit 3000 Taler abzüglich der anfallenden Steuern.</p> <p>Bitte beachten Sie, dass im Schnitt jede vierte Steuererklärung überprüft wird. Diese Überprüfung findet dabei nach der letzten Periode statt. Tritt bei der Überprüfung eine Differenz zwischen tatsächlichem Einkommen vor Steuer und angegebenem Wert auf, so wird diese Differenz vollständig als zusätzliche Abgabe einbehalten.</p> <p style="text-align: right;">Wert, den Sie als Bemessungsgrundlage für Ihre Steuer angeben möchten <input style="width: 50px;" type="text"/></p>
Nach Eingabe aller Daten klicken Sie bitte auf den Button "Eingabe bestätigen"	
<input type="button" value="Eingabe bestätigen"/>	

On the left-hand side of the screen the list of tax items were shown where choosing more than one item was possible. In the K treatment this list was shown without the possibility of choosing specific tax items. On the right-hand side subjects were asked to state what amount of their income they want do declare for the tax report.

**Table A3: List of options used in the K and the BS treatment (items were in German and sorted alphabetically)**

Item 1	Bilateral financial agreements
Item 2	Federal police
Item 3	Business administration of the German federal customs authority
Item 4	German patent office
Item 5	German federal railway
Item 6	Innovation and high-tech research
Item 7	Advancement for selective projects that make use of renewable energy
Item 8	State services for families
Item 9	Social insurance contributions and national assistance for soldiers
Item 10	Lump-sum reimbursement of the expenses of health insurances for services concerning the whole society
Item 11	Maintenance of the culture relationship with foreign countries
Item 12	Social Insurance
Item 13	Advancement for coal mining
Item 14	Governmental grant for farmers' old-age insurance
Item 15	Other
Item 16	Neutral

**A4. Braithwaite's statements (2003) representing commitment to tax system**

1. Paying tax is the right thing to do.
2. Paying tax is a responsibility that should be willingly accepted by all Australians [all Australians replaced by: the whole society].
3. I feel a moral obligation to pay my tax.
4. Paying my tax ultimately advantages everyone.
5. I think of tax paying as helping the government do worthwhile things.
6. Overall, I pay my tax with good will.
7. I resent paying tax.
8. I accept responsibility for paying my fair share of tax.

## A5. Derivation of individual risk preferences

As shown in Goeree et al (2003) when using a utility function with relative constant risk aversion the threshold  $p^*$  can be rewritten as a function of  $r$ :

$$p^*(r) = \frac{U(8) - U(0.50)}{U(19.25) - U(0.50) + U(8) - U(10)} = \frac{8^{1-r} - 0.50^{1-r}}{19.25^{1-r} - 0.50^{1-r} + 8^{1-r} - 10^{1-r}} \quad (1)$$

Assuming that subjects may do mistakes when deciding upon a binary choice we allow for noise in the existing model and introduce a probabilistic choice function that was first developed by Luce (1959) and was shown to approximate the choice behavior in the lottery quite well (see for example Holt/Laury 2002 and Goeree et al 2003). This continuous, steady increasing function takes the shape of a logistic function and gives for each alternative with its associated expected utility the probability that subjects will decide for that alternative. With higher associated expected utility the probability rises that this alternative will be chosen among others. With respect to our setup the probability of choosing lottery A over B thus can be expressed with the following probabilistic choice function:

$$p_A = \frac{\exp(U_A / \mu)}{\exp(U_A / \mu) + \exp(U_B / \mu)} = \frac{1}{1 + \exp((U_B - U_A) / \mu)} \quad (2)$$

The denominator ensures that each probability lies between 0 and 1. The parameter  $\mu$  expresses the noise in the decision-making process that arises due to insensitivity in payoff differences. For example, as  $\mu$  goes to zero, A is chosen with probability 1 if it yields a higher expected utility over B, in the opposite case, when  $\mu$  goes to infinity the decision becomes completely random as the expected utilities from A and B are perceived to be equal. In line with Holt/Laury (2002) and Goeree et al (2003) we normalize our utility function to avoid scaling effects on  $\mu$ . By specifying  $U$  in terms of  $U(x) = \frac{x^{1-r} - 0.50^{1-r}}{19.25^{1-r} - 0.50^{1-r}}$  the utility for all possible outcomes from the lottery is bounded between 0 and 1, where the worst possible outcome of 0.50 € provide the lowest utility of zero and the best possible outcome of 19.25 € the highest utility of 1. With this new specification the probability of choosing A over B can now be expressed as followed:

$$p_A = \frac{1}{1 + \exp((p - p \cdot 10^{1-r} - (1 - p) \cdot 8^{1-r}) / \mu)} \quad (3)$$

Using maximum likelihood estimation we are able to derive the  $r$  coefficient and the noise parameter out of the binary choices made by all subjects in our experiment.

Table A6

Risk categories, r-coefficients and average compliance rates for each treatment and tax system (number of subjects in brackets)

Risk categories	Tax system with high power of authorities				Tax system with low power of authorities			compliance rate for each risk category	overall compliance rate	r-coefficient
	BS	K	Con	compliance rate for each risk category	BS	K	Con			
risk loving	0.70 (4)	0.62 (9)	0.83 (4)	0.68 (17)	0.51 (4)	0.62 (4)	0.20 (6)	0.41 (14)	0.56 (31)	-0.382
risk neutral	0.74 (16)	0.64 (5)	0.61 (6)	0.69 (27)	0.75 (8)	0.71 (10)	0.44 (8)	0.63 (26)	0.67 (53)	0.014
slightly risk averse	0.62 (4)	0.68 (14)	0.66 (7)	0.67 (25)	0.63 (6)	0.66 (6)	0.48 (5)	0.60 (17)	0.64 (42)	0.282
risk averse	0.79 (28)	0.74 (23)	0.83 (33)	0.79 (84)	0.73 (32)	0.70 (22)	0.66 (30)	0.70 (84)	0.74 (168)	0.898
overall compliance rate	0.75 (52)	0.69 (51)	0.78 (50)		0.71 (50)	0.69 (42)	0.55 (49)			
r-coefficient	0.622	0.457	0.584		0.518	0.474	0.548			

**Instructions** (*Original instructions were in German. They are available from the authors upon request.*)