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Martin Fochmann/Joachim Weimann

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Verantwortlich für diese Ausgabe:
Martin Fochmann; Joachim Weimann
Otto-von-Guericke-Universität Magdeburg
Fakultät für Wirtschaftswissenschaft
Postfach 4120
39016 Magdeburg
Germany

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The Effects of Tax Salience and Tax Experience on Individual Work Efforts in a Framed Field Experiment*

Martin Fochmann† Joachim Weimann‡

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Abstract

We conduct a framed field experiment with 245 employed persons (no students) as subjects and a real tax, which is levied on the subjects' income from working in our real effort task. In our first three treatments, the net wage is constant but gross wages are subject to different constant marginal tax rates (0, 25%, 50%). It turns out that the effort is significantly higher under the tax than in the no tax treatment. Subjects perceive a too high net wage because they underestimate the tax. We conjecture that tax perception depends on the tax rate, the presentation of the tax and the experience subjects have with taxation. These conjectures are confirmed in four further treatments employing a direct and an indirect progressive tax scale. It turns out that simple flat taxes are particularly prone to being misperceived because their simplicity reduces the tax salience.

Keywords: Field experiment, real effort experiment, tax perception, tax salience, tax experience, behavioral economics

JEL-Classification: C91, D14, H24

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†Martin Fochmann, Chair of Economic Policy, University of Magdeburg, PO Box 4120, D-39016 Magdeburg, Germany, email: martin.fochmann@ovgu.de, phone: +49 (0)391 67 12158. (corresponding author)

‡Prof. Dr. Joachim Weimann, Chair of Economic Policy, University of Magdeburg, PO Box 4120, D-39016 Magdeburg, Germany, email: joachim.weimann@ovgu.de, phone: +49 (0)391 67 18547.

1 Introduction

In the economic literature on taxes, behavioral aspects do not usually play a prominent role. For example, the theory of optimal taxation assumes that taxpayers adapt to a given tax scale rationally by maximizing their utility. Phenomena like "inequality aversion" (Fehr and Schmidt, 1999; Bolton and Ockenfels, 2000), "reciprocity" (Fehr and Gächter, 1998) or "altruism" (Andreoni and Miller, 2002), intensively discussed in the area of behavioral economics, do not play a role in this theory for good reasons. On the other hand, it must be realized that there is experimental evidence that a fundamental assumption made in theories about the effects of taxation may be violated in reality: the assumption that taxpayers perceive the tax as implemented by the government.

There is a variety of papers showing that subjects in laboratory experiments or the participants in surveys are not aware of their true tax burden. For example, Gensemer et al. (1965), Morgan et al. (1977), Lewis (1978) and Rupert and Fischer (1995) find in their surveys that taxpayers misestimate their marginal tax rates. In a laboratory experiment, Bartolome (1995) shows that most of the subjects underestimate their tax burden in investment decisions since they use the average tax rate instead of the marginal tax rate. More recently, Chetty et al. (2009) show in a field experiment that subjects do not consider taxes correctly when they decide on their consumption of goods in a store.

In an assortment of studies, the salience of a tax—the degree of tax visibility—is identified as the main determinant of tax perception. In a laboratory experiment, Rupert and Wright (1998) use four different presentation forms of a tax scale that differ in the visibility of the marginal tax rates, and find that the quality of investment decisions increases with the visibility. Sausgruber and Tyran (2005) find that subjects are much more aware of taxes if they have to pay the tax bill than if the other market side has to pay. Chetty et al. (2009) observe in their field experiment that an explicit tax posting on price tags induces consumers to pay more attention to taxes. In the same manner, Finkelstein (2009) finds that the awareness of tolls is much lower when individuals pay the toll automatically by using an electronic toll collection system than when paying in cash. All of these studies reveal that the higher the salience of a tax, the higher the tax perception. Thus, the degree of tax consideration in individuals' decisions is affected by tax salience.

Given these observations, the question arises, why is tax perception biased or, considering it the other way around, what are the necessary conditions for a correct perception of tax? Answering this question is not only important for governments trying to create tax-systems that produce correctly perceived taxes, but also for the

economic analysis of taxes. For example, if taxes are misperceived, this affects the welfare analysis of taxation because the excess burden of taxes becomes smaller or greater due to the perception bias.

In this paper, we investigate the way taxes are perceived in a framed field experiment[1] with a real effort task in which subjects have to decide on their labor supply. Some experiments described in the literature already use real effort designs to analyze the impact of taxes. But the experimental designs used in these experiments do not allow potential misperceptions of taxes to be investigated. For example, in the experiments of Sillamaa (1999a, 1999b, 1999c) and Swenson (1988), only the after-tax wage rate was announced and any kind of tax framing was avoided. Furthermore, in order to control for income effects, the tax revenue is redistributed to the subjects. The work-leisure decision is established in the laboratory by offering subjects newspapers and computer games they could use instead of working—which is quite different from the real work-leisure decision people have to make when they decide on their labor supply.

In contrast to the existing literature, we designed the experiments in such a way as to achieve as much external validity as possible. For this reason, we used employed people as subjects (no students) and conducted a real effort experiment. Furthermore, subjects had to make a real work-leisure decision because they decided not only about their effort but also about the time they spent on work. There was no time restriction. Because the experiment was financed by the German Federal Ministry of Finance, we could use real taxes. On the other hand, we did not redistribute the taxes to the subjects because, in the real world, the quantity of public goods taxpayers consume is, in fact, independent of the taxes they personally pay.

The experiments are designed to investigate three different hypotheses concerning the determinants of tax perception. The first hypothesis is that tax perception depends on the tax rate itself. We conjecture that when tax rates are low, subjects will tend to underestimate the tax and that the tax bias will become smaller, the higher the tax rates. We formulate this hypothesis for linear tax scales only in order to avoid the difficulty of differentiating between marginal and average tax rates. Our second hypothesis concerns the way taxes are presented to the taxpayer. To investigate this hypothesis, we use two tax scales that are more difficult and complex: an indirect progressive tax and a direct progressive tax. These complex scales are presented in a more or less transparent way (either only verbally or with a graphical illustration). We conjecture that tax perception depends on the transparency of the

[1] According to Harrison and List (2004) our experiment can be regarded as a framed field experiment because we used employees as subjects and a real tax on labor income.

tax presentation. The third hypothesis concerns the characteristic of the subjects. Our conjecture in this case is that the experience subjects have with the taxation of earned labor income affects tax perception: the more experience subjects have, the smaller the tax bias will be.

In the next section, we will briefly describe the theoretical framework of our experiment. Section three describes the experimental design and presents the three hypotheses more precisely. The results are presented in section four and discussed in the final section.

2 Theoretical framework

In our experiment, participants are asked to produce a good in a real effort task without any time restriction. The total number of goods produced by subject i is x_i and the subject earns the gross wage rate w for each unit of x_i. Income is subject to an income tax and the total tax burden of an individual is $\tau(x_i)$. The total net of tax income equals $wx_i - \tau(x_i)$. The production costs c (subject's disutility of labor) depend on the output level and we assume that $\frac{\partial c(x_i)}{\partial x_i} > 0$ and $\frac{\partial^2 c(x_i)}{\partial^2 x_i} > 0$. Because each subject decides on the working time individually, the output level x_i depends on both the time t_i a subject spends in the laboratory and on the effort level e_i. The latter is defined as output quantity per time unit and measures the productivity of a participant approximately. The output level is then determined by $x_i = e_i t_i$ and the following payoff function results:

$$\pi_i(e_i t_i) = we_i t_i - \tau(e_i t_i) - c(e_i t_i) \tag{1}$$

As described above, the baseline hypothesis of this paper is that taxpayers do not perceive taxes correctly. To consider such a tax bias in our model, we introduce the variable $\hat{\tau}$ which represents the perceived tax burden. In the case of an underestimation (overestimation) of the tax effect, the perceived tax burden $\hat{\tau}$ is lower (higher) than the true tax burden τ. The difference between the perceived and the true value—the tax bias—is denoted as $\Delta\tau = \hat{\tau} - \tau$. Since individuals base their labor supply decisions on their perceived (expected) payoff, subjects are assumed to maximize:

$$\pi_i(e_i t_i) = we_i t_i - \hat{\tau}(e_i t_i) - c(e_i t_i) = we_i t_i - \tau(e_i t_i) - \Delta\tau(e_i t_i) - c(e_i t_i) \tag{2}$$

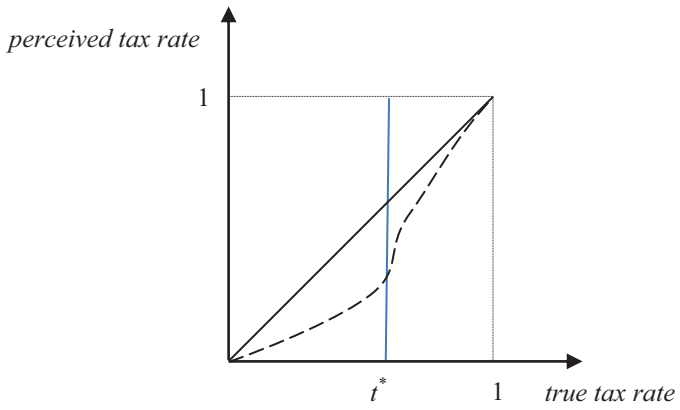

Figure 1: Perceived tax rate as a function of the true tax rate

If we normalize the time spent in the laboratory ($t_i = 1$), we get the necessary condition for the payoff maximizing effort:

$$w - \frac{\partial \hat{\tau}}{\partial e_i} = \frac{\partial c(e_i)}{\partial e_i} \tag{3}$$

In the optimum, the (perceived) marginal net wage rate equals the marginal effort costs. Given the assumptions made for the cost function, the optimal effort will increase if the gross wage rate w increases. The reaction to an increase in the real (marginal) tax rate obviously depends on how $\hat{\tau}$ depends on τ.

Turning to the relationship between the perceived tax burden $\hat{\tau}$ and the true tax burden τ, we assume that the tax bias is zero for tax rates (t) of 0% and 100%. The tax can be over- or underestimated for tax rates inbetween. In both cases, there has to be an area in which the difference between perceived and true tax rate firstly increases and, therefore, also the tax (burden) bias, followed by an area in which this difference and also the tax (burden) bias decreases. Figure 1 shows an example. The solid line (45-degree line) represents an unbiased tax perception. The dashed line represents an underestimation of the tax effect, with the absolute tax (rate) bias increasing for tax rates less than t^* and decreasing for tax rates greater than t^*.

3 Treatments and hypotheses

To derive our hypotheses, we will focus only on subjects' efforts. The decisions about the time spent in the laboratory will be ignored because we do not have enough control over the opportunity costs driving these decisions. For example, it may be the case that a subject has an appointment later or that the subject's wife or husband is waiting for dinner. Thus, we assume that the decision about time and

effort are additively separable. Subjects decide how hard they are going to work given their optimal chosen labor time.[2]

It is well known that the ability to do simple tasks improves with practice. The learning process can best be described by the "Power Law of Learning" (PLL)[3] which states that productivity is an isoelastic function of practice time. Thus, if e_i is the productivity (or effort) of person i and t_i is the time spent folding letters, then according to the PLL it holds that $e_i(t_i) = gt_i^{\eta}$ with $0 < \eta < 1$. Where g and η are parameters describing the learning ability of the individual. We cannot rule out that the participants in our experiments differ with respect to these parameters. In principle, it is possible to estimate g and η but this would make it necessary to observe the productivity of each individual over the entire time they spend in the laboratory. We decided against this because if a person is observed that closely, it would surely influence his or her behavior. However, we controlled for demographic parameters like gender, education and age. We found that "age" has a significant influence on productivity but that controlling for this does not change the treatment effects. This gives us confidence that the randomization was successful and the productivity parameters are equally distributed over the treatments.

3.1 Tax effect: tax-free, 25% tax, and 50% tax treatments

In line with the empirical results of Gensemer et al. (1965), Morgan et al. (1977), Lewis (1978), Bartolome (1995), Rupert and Fischer (1995), and Chetty et al. (2009), we conjecture that individuals misperceive the tax effect. Even though the perceived tax burden $\hat{\tau}$ is not observable, the effort levels will depend on participant' tax perception. Therefore, we can use the observed effort levels in our different tax treatments to characterize tax perception at least in a qualitative way. According to equation 3, the necessary condition for the payoff maximizing effort is:

$$\frac{\partial c(e_i)}{\partial e_i} = w - \frac{\partial \hat{\tau}}{\partial e_i} = w - \frac{\partial \tau}{\partial e_i} - \frac{\partial \Delta\tau}{\partial e_i} \tag{4}$$

In order to analyze tax-effect biases, we consider three treatments with *identical net wage rates* of 9 euro-cents per produced item but with different tax rates and gross wage rates adjusted accordingly. In the *tax-free treatment*, no taxation is applied. In the *25% tax treatment* (*50% tax treatment*), the gross wage rate is 12 (18) euro-cents, but now it is taxed at a constant rate of 25% (50%). With respect to equation

[2]Despite this difficulty, we decided to leave the decision on the length of the experiment to the subjects, because our aim was to create a real work-leisure decision.

[3]See Mincer (1958), Ritter and Schooler (2001), and Richter (2011).

4, the term $w - \frac{\partial \tau}{\partial e_i}$, which determines the true marginal net wage rate, is the same in all three treatments (9 cents). Therefore, the effort should be the same in all treatments if no tax misperception exists ($\frac{\partial \Delta \tau}{\partial e_i} = 0$). Recall that for linear tax scales $\frac{\partial \tau}{\partial e_i}$ and $\frac{\partial \Delta \tau}{\partial e_i}$ are constant. The last term can be interpreted as the fraction of the tax that is not correctly realized as a tax.

In line with the empirical results of Bartolome (1995) and Chetty et al. (2009), we expect that participants underestimate the tax effect. In our model, this is represented by a negative value of $\Delta\tau$. For a constant (marginal and average) tax rate (as in our 25% and 50% tax treatments), $\frac{\partial \Delta \tau}{\partial e_i}$ is also constant and negative. Since the cost function is assumed to be convex, subjects' effort in both tax treatments should be greater than subjects' effort in the tax-free treatment. This leads us to the following hypothesis:

Hypothese 1 (part 1): Participants' effort level is lower in the tax-free treatment than in the 25% tax treatment and 50% tax treatment.

Based on our assumptions regarding the relationship between the perceived and true tax rate (see figure 1), the tax bias $\Delta\tau$ in the 25% tax treatment can be equal, higher, or lower than the tax bias in the 50% tax treatment. However, if we assume that an increase of the (average and marginal) tax rate from 25% to 50% leads to a decline in tax misperceptions, a lower effort should be observed in the 50% tax treatment than in the 25% tax treatment for a constant gross wage rate w. In order to compare the efforts, the net wage rates in the linear tax treatments have to be identical. Therefore, the gross wage rate in the 50% treatment has to be higher than in the 25% treatment. Comparing the 25% and the 50% treatments we need to consider both the increase of the gross wage rate and the effect of a higher tax rate on the tax perception. Both effects will work in different directions. For a given tax misperception (a given constant fraction of the true tax that is ignored) an increase of the gross wage rate will lead to higher efforts. On the other hand, a higher tax rate will make the tax more salient and this will result in a lower tax misperception (a smaller fraction of the true tax is ignored) and, therefore, in a lower effort level. However, we conjecture that the first effect will not dominate the second. Therefore, we obtain the following hypothesis:

Hypothese 1 (part 2): Participants' effort level in the 50% tax treatment is not higher than in the 25% tax treatment.

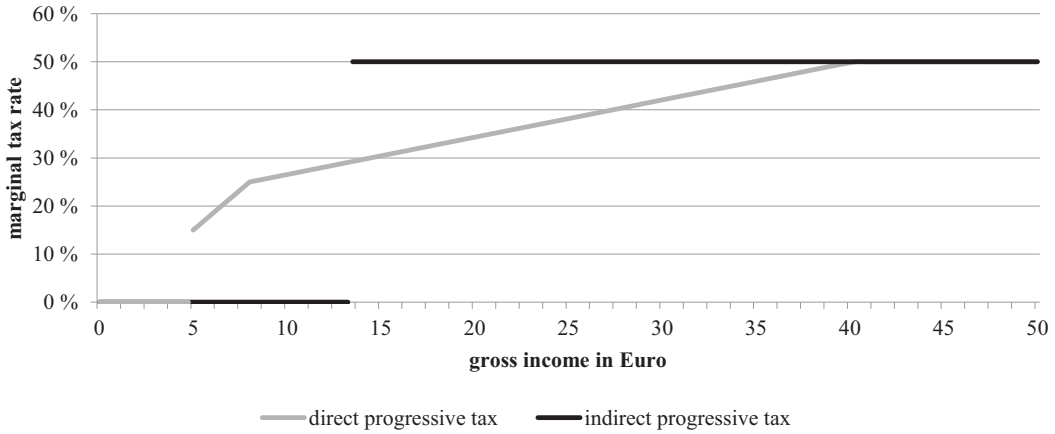

Figure 2: Marginal tax rates in the progressive tax treatments

3.2 Tax presentation effect: indirect (-), indirect (+), direct (-), and direct (+) tax treatments

The next hypothesis concerns the presentation of complex tax scales. We conjecture that the more transparent the presentation of a tax scale, the smaller the tax perception bias. To test this hypothesis, we apply two progressive tax scales: an indirect progressive tax on earned income in the *indirect (-)* and *indirect (+) tax treatments* and a direct progressive tax in the *direct (-)* and *direct (+) tax treatments*. The gross wage rate is identical in all of these four treatments.

The indirect progressive tax scale consists of a tax-free bracket up to 13.50 euros and a constant marginal tax of 50% starting at 13.50 euros. The direct progressive tax scale mimics the actual German income tax scale. Between 0 and 5 euros there is no taxation. Between 5 and 8 euros the marginal tax rate increases from 15% to 25%. Between 8 and (approximately) 42 euros the marginal tax rate increases from 25% to 50% and for all incomes above 42 euros the marginal tax rate is constant at 50%. Figure 2 displays the marginal tax rates of both progressive tax scales.

To test the effect of more or less transparent tax presentations, both progressive tax scales are presented in two different ways. In the indirect (-) [direct (-)] tax treatment, the indirect [direct] progressive tax scale is only described verbally and in the indirect (+) [direct (+)] tax treatment a graphical illustration is added. Figure 3 shows how the direct progressive tax is illustrated graphically (the graph for the indirect tax is similar).

To analyze the influence of transparency on tax perception, only the effort difference between the indirect (-) and indirect (+) as well as between the direct (-) and direct (+) is of importance. According to equation 4, the term $w - \frac{\partial \tau}{\partial e_i}$ is unaffected by the tax presentation within each progressive tax scale. However, the explicit

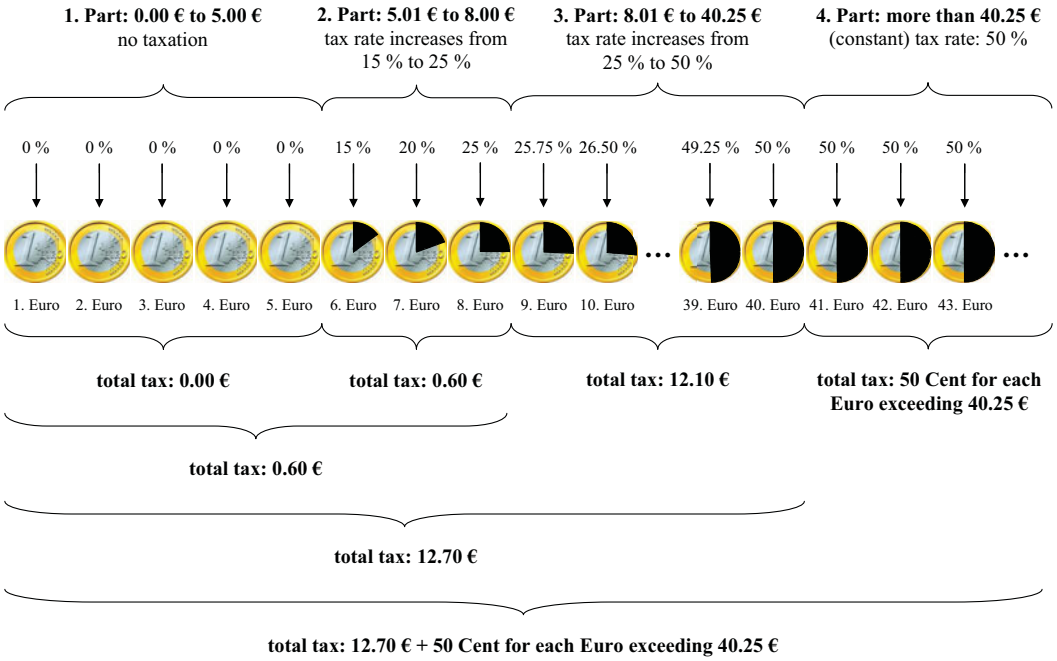

Figure 3: Graphical illustration of the direct progressive tax scale

tax scale presentation in the indirect (+) and direct (+) tax treatments is expected to lead to a lower degree of tax misperception, i.e. $\left|\frac{\partial \tau_{indirect(-)}}{\partial e_i}\right| \geq \left|\frac{\partial \tau_{indirect(+)}}{\partial e_i}\right|$ and $\left|\frac{\partial \tau_{direct(-)}}{\partial e_i}\right| \geq \left|\frac{\partial \tau_{direct(+)}}{\partial e_i}\right|$. Under the assumption that subjects also underestimate progressive taxes, the effort should then be lower in the treatments with the explicit tax presentation. This leads to our second hypothesis:

Hypothese 2: Participants' effort level is lower in the indirect (+) [direct (+)] tax treatment than in the indirect (-) [direct (-)] tax treatment.

3.3 Tax experience effect: all treatments

We conjecture that tax perception not only depends on the tax effect and the tax presentation effect, but also on individuals' tax experience. For an individual to gain this experience, it is necessary to have a personal income that is high enough to create a tax obligation. In Germany, income taxation concentrates very much on higher incomes. Tax is payable on monthly incomes of more than 1,000 euros for single people and 1,700 euros for married people. Therefore, those subjects in our subject pool with an income below 2,000 euros are classified as subjects with no or only limited experience and those with an income above 2,000 euros are the "experienced" subjects.

Table 1: Characterization of treatments

treatment	tax scale	gross wage rate	marginal tax rate	net wage rate	tax scale presentation	number of participants
tax-free	no taxation	€ 0.09	—	€ 0.09	—	60
25% tax	proportional income taxation	€ 0.12	25%	€ 0.09	no	36
50% tax	proportional income taxation	€ 0.18	50%	€ 0.09	no	31
indirect (-)	indirect progressive taxation with tax-free bracket	€ 0.12	0% or 50%	(€ 0.06; € 0.12)	no	26
indirect (+)	indirect progressive taxation with tax-free bracket	€ 0.12	0% or 50%	(€ 0.06; € 0.12)	yes	29
direct (-)	direct progressive taxation	€ 0.12	[0%; 50%]	(€ 0.06; € 0.12)	no	27
direct (+)	direct progressive taxation	€ 0.12	[0%; 50%]	(€ 0.06; € 0.12)	yes	36

We hypothesize that subjects with more tax experience are more aware of taxes than inexperienced subjects and this higher sensitivity will lead to a more accurate tax perception. Therefore, $\left|\frac{\partial \tau_{inexperienced}}{\partial e_i}\right| \geq \left|\frac{\partial \tau_{experienced}}{\partial e_i}\right|$. In accordance with equation 4 and under the general expectation that the subjects will underestimate the taxes in all tax treatments, hypothesis 3 can be stated as follows:

Hypothese 3: In all tax treatments, the effort levels of experienced subjects are lower than the levels of inexperienced subjects.

Table 1 summarizes the characteristics of all seven treatments.

4 Experimental protocol

The experiments were conducted at the experimental laboratory of the local university. Subjects were recruited randomly from the local telephone book. Potential subjects first received a letter in which they were informed that they could attend an experiment at the university if they were regularly employed with a minimum working time of 30 hours per week. A day later we called the subjects, asking if they fulfilled our requirements and if they were willing to participate. Those who agreed were invited to come to the laboratory in the late afternoon, after their regular working time. In total, 245 subjects participated. When they arrived at the laboratory, they received written instructions informing them about their task, the gross wage rate and the tax scale. The task was to fold letters and put them into

Table 2: Summary statistic over all treatments

	mean	median	standard deviation
number of letters folded	178.04	150.00	134.06
minutes in the lab	71.90	65.00	40.61
effort	2.416	2.326	0.69
net wage rate (in euro)	16.42	14.40	11.47

Table 3: Effort levels (number of folded letters per minute) in the tax-free, 25% tax and 50% tax treatments

treatment	mean	median	standard deviation
tax-free	2.283	2.134	0.746
25% tax	2.687	2.410	0.746
50% tax	2.604	2.786	0.484

an envelope. The subjects were told that they could decide how long to stay in the laboratory. They could stop working whenever they wanted to and there was no time restriction. The subjects were located at computer desks, separated from each other, in soundproof booths. No communication was allowed during the experiment. Subjects were paid immediately after the experiment and received a show-up fee of 5 euros.

5 Results

The subjects folded about 43,300 letters over all treatments. Table 2 summarizes the mean, median, and the standard deviation of the number of folded letters, the time spent in the laboratory, the effort and the realized net income over all treatments.

The first hypothesis concerns the question of how subjects react to a simple flat tax. A comparison of the effort levels in the tax-free treatment with those in the 25% tax and 50% tax treatments clearly shows that the effort levels under a flat tax are higher than without taxation (see table 3 and figure 4).

The differences between the tax-free and the 25% tax treatments and between the tax-free and the 50% tax treatments are highly significant ($p = 0.007$ and 0.005, Mann-Whitney-U-test, two-sided). Obviously, the first part of hypothesis 1 can be confirmed. The subjects seem to ignore the flat tax to a great extent and demonstrate a kind of "net-wage illusion". They behave as if a significant fraction of the

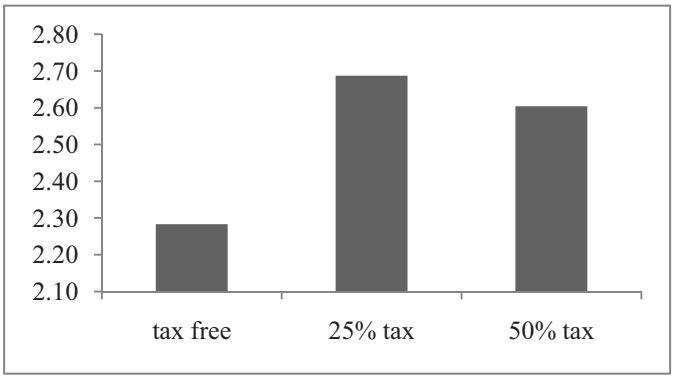

Figure 4: Effort levels on average in the tax-free, 25% tax and 50% tax treatment

tax is part of their net income. We can conclude that the tax bias $\Delta\tau$ is negative (i.e. an underestimation of the tax effect) in the 25% tax and 50% tax treatments.

The second part of hypothesis 1 claims that an increase in the flat tax rate from 25% to 50% will increase the tax salience and, therefore, lead to a smaller tax bias. The data show that there is no significant difference between the efforts in the 25% tax and 50% tax treatments ($p = 0.860$, Mann-Whitney-U-test, two-sided). If it is true that the effort depends on the perceived net wage rate, this implies that the net wage rates in both tax treatments are perceived as identical. Obviously, the two effects described in section 3.1 cancel each other out. On the one hand, the increase in the gross wage rate (from 12 to 18 cent per letter) increases the perceived net wage rate for a given net-wage illusion. On the other hand, the increase of the tax rate makes taxation more salient, which leads to a lower tax misperception and, therefore, to a decrease in the perceived net wage rate. While the first effect makes the effort level go up, the second works in the opposite direction. Thus, the second part of hypothesis 1 is also confirmed. A higher tax rate increases the tax salience and leads to a smaller tax misperception.

In order to test the second hypothesis, it is necessary to compare the results of the progressive tax treatments with and without the graphical illustration. Table 4 and figure 5 show the effort levels in these treatments.

As a result, the graphical presentation of the tax leads to lower effort levels for both kinds of progressive tax scales. The fact that this is only weakly significant for the indirect progressive tax scale ($p = 0.057$) is surprising because the tax scale used in both the indirect (-) and the indirect (+) treatments is already very simple considering that it has only two marginal tax rates (0% and 50%). Nevertheless, explaining this simple form of taxation in more detail causes a significant decrease in the effort level. On the other hand, this is not true for the much more complex

Table 4: Effort levels in the treatments with a progressive tax scale

treatment	mean	median	standard deviation
indirect (-)	2.569	2.470	0.637
indirect (+)	2.273	2.151	0.721
direct (-)	2.421	2.283	0.703
direct (+)	2.208	2.176	0.582

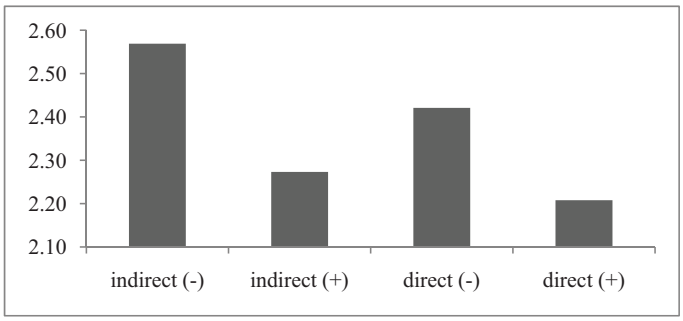

Figure 5: Effort levels on average in the treatments with a progressive tax scale

tax scale in the direct (-) and direct (+) tax treatments. A possible explanation for this result is that the complexity of a tax scale is a determinant of its salience. The more complex taxes are, the more salient the taxation is. This interpretation is in line with the observation that the extremely simple tax scales in the 25% tax and 50% tax treatments are not perceived correctly.

The last hypothesis concerns the role of experiences made with income taxation. Table 5 shows the average and median (in brackets) effort levels of experienced (high income) and inexperienced (low income) subjects. The distribution of experienced and inexperienced subjects in each treatment is presented in brackets in the first column and the p-value results from a Mann-Whitney-U-test (two-sided). Figure 6 plots the average effort levels of both subject groups.

It turns out that experience with taxation does not provide any protection against tax perception bias at all. In the flat tax treatments, 25% tax and 50% tax, the higher income group always shows a higher effort level than the low income subjects (although not significantly). Experience becomes important when the tax scales become more complex. Starting with the indirect (-) treatment, the effort levels of the experienced subjects are always below those of the inexperienced. It is only in the direct (-) treatment, however, that the difference is significant. In this treatment, expert knowledge has the highest value because the tax scale is complicated and only described verbally. But the results of the direct (+) treatment demonstrate that

Table 5: Average and median (in brackets) effort levels of experienced and inexperienced subjects

treatment	inexperienced	experienced	p-value
tax-free [19/41]	2.171 (2.083)	2.335 (2.281)	0.409
25% tax [6/29]	2.618 (2.512)	2.743 (2.380)	0.861
50% tax [10/19]	2.489 (2.401)	2.685 (2.818)	0.359
indirect (–) [15/11]	2.712 (2.651)	2.375 (2.393)	0.139
indirect (+) [5/23]	2.760 (2.108)	2.148 (2.151)	0.490
direct (–) [10/16]	2.681 (2.532)	2.314 (2.162)	0.092
direct (+) [15/17]	2.294 (2.313)	2.155 (2.000)	0.257

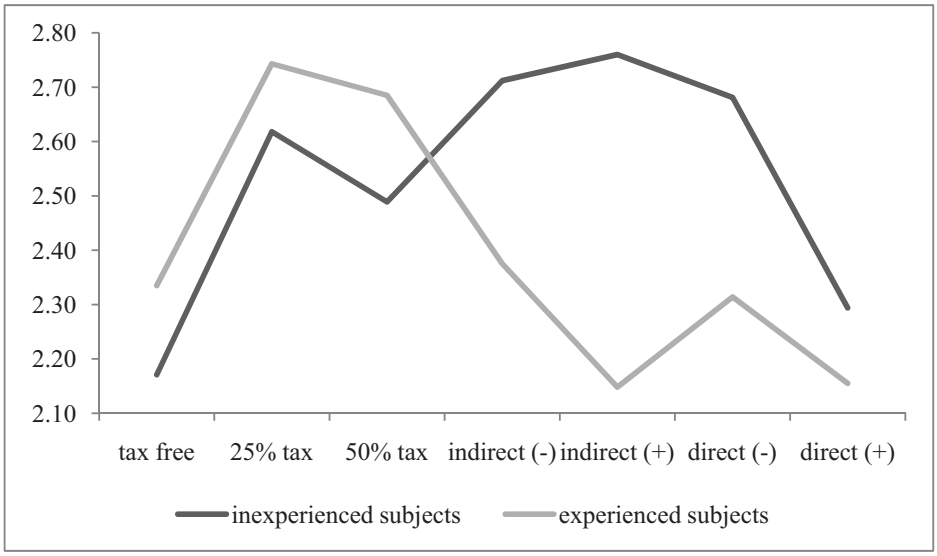

Figure 6: Average effort levels of experienced and inexperienced subjects

expert knowledge can be substituted by a better and more transparent presentation of the tax.

Table 6 shows the results of a linear regression analysis with the effort level as the dependent variable. As independent variables, we use dummies for each treatment, which take the value of 1 if a subject participated in the respective treatment. The tax free treatment is the default and, therefore, the coefficient of a dummy variable measures the difference between the respective tax treatment and the tax free treatment. Furthermore, we include the information we obtained from an ex post questionnaire: dummies are introduced for 'gender' (female = 0, male = 1), 'education' (low educational level = 0, high educational level = 1)[4] and 'income' (net household income per month below € 2,000 = 0, above € 2,000 = 1). Furthermore, we use a dummy which takes the value of 1 if the person is in an 'executive position', a dummy for 'brain work' (no brain work = 0, brain work = 1), and a dummy for the question of whether the person had worked the day the experiment was carried out (if yes then 'worked today' = 1). The variable 'age' is measured on a 6-point scale from 1 (20 – 25) to 6 (older than 65). We further asked the subjects how they felt at work in general ('value work') and how exhausting they found the experiment ('experiment exertion'). Both were measured on a 10-point scale from 1 (totally dissatisfied / relaxing) to 10 (deeply satisfied / exhausting). The variable 'hours per week' indicates the number of hours a participant works per week on average. We consider the results of all the subjects in model 1 and 2, whereas we split the subject pool into those who earned more than 2,000 euros (experienced subjects) and those with an income below that level (inexperienced subjects) in models 3 and 4 to control for the experience effect.

In general, the results of our regression analyses are in line with our previous findings. With respect to model 1 and 2, we find a significant increase in the effort in both flat tax treatments. This increase is also observed in the other models for both experienced and inexperienced subjects, however, the difference is not significant at all. In (nearly) all models, we observe a somewhat smaller increase in the 50% tax treatment than in the 25% tax treatment which confirms our conjecture that a higher tax rate increases tax salience and, therefore, decreases tax misperceptions. Furthermore, the analyses confirm our observation that a more transparent tax presentation reduces tax biases (except for the inexperienced subjects with the indirect progressive taxation).

[4]Low educational level includes the answers: no completed apprenticeship, completed apprenticeship, and master craftsman. High educational level includes the answers: college (university of applied sciences) degree and university degree.

Table 6: Linear regressions with "effort" as dependent variable

	model 1	**model 2**	**model 3**		**model 4**	
	all subjects	all subjects	inexp. subjects	exp. subjects	inexp. subjects	exp. subjects
constant	2.283***	2.658***	2.171***	2.335***	2.972***	2.497***
25% tax	0.403***	0.279**	0.447	0.408**	0.228	0.276*
50% tax	0.321**	0.265*	0.318	0.350*	0.267	0.251
indirect (-)	0.286*	0.175	0.541**	0.039	0.339	0.060
indirect (+)	-0.011	-0.102	0.589*	-0.187	0.585*	-0.287*
direct (-)	0.138	0.066	0.510*	-0.022	0.321	-0.085
direct (+)	-0.076	-0.142	0.123	-0.180	0.004	-0.160
age		-0.159***			-0.160**	-0.188***
gender		-0.469***			-0.548*	-0.433***
education		0.114			0.000	0.141
hours worked		0.001			-0.005	0.004
brain work		0.058			0.113	0.021
executive position		0.070			-0.046	0.144
worked today		0.148			0.157	0.154
value work		0.054**			0.036	0.054**
experiment exertion		-0.031			-0.027	-0.019
income		-0.075			—	—
R^2	0.065	0.291	0.104	0.104	0.315	0.346
adjusted R^2	0.041	0.238	0.031	0.068	0.154	0.275
model's p-value	0.013	0.000	0.220	0.011	0.033	0.000

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

The results of model 3 and 4 reveal a strong tax experience effect in the complex tax treatments. Compared to the results of the tax free treatment, inexperienced subjects increased their effort in all progressive tax treatments, but experienced subjects did not. In nearly all of these treatments, subjects with tax experience actually decreased their effort. However, in the direct tax treatment, the large difference between the groups vanishes when individuals received a graphical illustration of the tax system. Therefore, we can conclude that a very transparent tax presentation can compensate for tax inexperience.

With respect to demographic variables, we observe that "age", "gender", and "value work" have a significant negative impact on effort. However, controlling for these effects does not change the significant treatment effects we have already detected.

6 Discussion

The experimental results reported in this paper demonstrate that the perception of taxes can be heavily biased. Surprisingly, it turns out that most notably very simple forms of taxation are in danger of causing tax perception bias. The strongest form of misperception was observed when the labor income was subject to a flat tax of 25%, with our non-student subjects increasing their effort significantly as compared to the subjects in the tax-free treatment. The tax rate itself is also a determinant of tax perception. The stronger the taxation, the more salient the tax – even a simple flat tax. A possible explanation for the higher effort levels in the treatments with 25% and 50% taxes could be that subjects like to work for the government or derive utility from producing public goods. If this is a true explanation, however, we should not observe that subjects work less hard if they are more aware of the tax. But the results of our last four treatments show that this is precisely what happens.

A promising way to overcome the misperception of taxes is their transparent presentation. Once again, this is particularly true for simple taxes. Progressive tax scales with more than one marginal tax rate have a higher salience, simply because they are more complex. Nevertheless, a graphical illustration also improves the correctness of tax perception for these tax scales.

Experience with taxation does not prevent taxpayers from experiencing a net-wage illusion when taxes are simple and, therefore, not salient. It does, however, become valuable when taxes are more complicated and in need of more transparent explanation. Furthermore, this experience can be supplemented with a clear presentation of complicated tax scales so that people with little, or no, tax experience also have a fair chance of perceiving taxes as they are.

Appendix

A Instructions

The instructions of all the treatments differ only in one specific passage. Therefore, we first present the general instructions, which are identical in all the treatments, and then the specific instructions of each treatment. The instructions were originally written in German.

A.1 General instructions

By participating in this experiment, you have the opportunity to earn money. The payoff at the end of the experiment depends on your individual effort. Please read the instructions carefully. If you have any further questions, please ask the experimenter.

Primary note:

The aim of this experiment is to obtain information about the individual labor supply. For this purpose you will be confronted with a real work task, with which you earn money. To compare the data of various research participants, a work task has been chosen in such a way that absolutely no previous knowledge or special talent is required and that it is easy to measure.

Procedure:

We would like to point out that communicating with other participants or leaving your seat is not allowed for the duration of the whole experiment. After reading the instructions, you will receive letters and envelopes. Your task is to fold these letters and to put them into the envelopes. Please seal the envelopes. The letters are used to acquire research participants in Magdeburg.
You determine your working time yourself. This means that there is no time limit and you can stop the experiment at any time. Afterwards, you will receive your payoff in accordance with the following rule and you are then allowed to leave the laboratory.

[specific instructions of a treatment]

After this experiment, we will ask you to fill out a short questionnaire. We would like to emphasize that we do not record you name at any time and, therefore, all your statements remain anonymous.
Enjoy yourself!

A.2 Specific instructions of the tax-free treatment

You will receive a payoff at the end of the experiment that depends on the number of letters folded and put into envelopes. You will receive 9 cents for each letter. If you fold on average 2 letters per minute, this leads to an hourly wage of 10.80 euros, 2.5 letters to 13.50 euros and 3 letters to 16.20 euros. The money you earn will be paid to you in cash at the end of the experiment.

A.3 Specific instructions of the 25% tax treatment

You will receive a payoff at the end of the experiment that depends on the number of letters folded and put into envelopes. You will receive 12 cents for each letter. If you fold on average 2 letters per minute, this leads to an hourly wage of 14.40 euros, 2.5 letters to 18.00 euros and 3 letters to 21.60 euros. A tax at a rate of 25% will be deducted from your earned amount, and the rest will be paid to you in cash at the end of the experiment.

A.4 Specific instructions of the 50% tax treatment

You will receive a payoff at the end of the experiment that depends on the number of letters folded and put into envelopes. You will receive 18 cents for each letter. If you fold on average 2 letters per minute, this leads to an hourly wage of 21.60 euros, 2.5 letters to 27.00 euros and 3 letters to 32.40 euros. A tax at a rate of 50% will be deducted from your earned amount, and the rest will be paid to you in cash at the end of the experiment.

A.5 Specific instructions of the indirect (-) and indirect (+) tax treatment

You will receive a payoff at the end of the experiment that depends on the number of letters folded and put into envelopes. You will receive 12 cents for each letter. If you fold on average 2 letters per minute, this leads to an hourly wage of 14.40 euros, 2.5 letters to 18.00 euros and 3 letters to 21.60 euros. Your income will not be subject to a tax up to an earned amount of 13.50 euros. A tax at a rate of 50% will be deducted from each amount above 13.50 euros, and the rest will be paid in cash to you at the end of the experiment.

A.6 Specific instructions of the direct (-) and direct (+) tax treatment

You will receive a payoff at the end of the experiment that depends on the number of letters folded and put into envelopes. You will receive 12 cents for each letter. If you fold on average 2 letters per minute, this leads to an hourly wage of 14.40 euros, 2.5 letters to 18.00 euros and 3 letters to 21.60 euros. A tax will be deducted from your earned amount, and the rest will be paid to you at the end of the experiment in cash. The tax burden depends on your total amount and is determined as follows:

Bracket 1: Your total amount is between 0.00 euros and 5.00 euros:

If your total amount is not higher than 5.00 euros, no tax will be imposed.

Bracket 2: Your total amount is between 5.01 euros and 8.00 euros:

A tax is deducted from each amount above 5.00 euros. The tax rate uniformly increases from 15% (at 5.01 euros) to 25% (at 8.00 euros) in this bracket.

Bracket 3: Your total amount is between 8.01 euros and 40.25 euros:

If your total amount is in this bracket, a lump sum tax of 0.60 euros will be levied.
In addition to this tax, a further tax is deducted from each amount above 8.00 euros. The tax rate uniformly increases from 25% (at 8.01 euros) to 50% (at 40.25 euros) in this bracket.

Bracket 4: Your total amount is above 40.25 euros:

If your total amount is in this bracket, a lump sum tax of 12.70 euros will be levied.
In addition to this tax, a further tax is deducted from each amount above 40.25 euros. The tax rate is always 50%.

B Raw Data

subject	treatment	folded letters	time (min)	effort (letters per min)	tax experience
1	tax-free	94	39	2.410	inexperienced
2	tax-free	30	24	1.250	inexperienced
3	tax-free	93	44	2.114	inexperienced
4	tax-free	215	73	2.945	inexperienced
5	tax-free	217	107	2.028	inexperienced
6	tax-free	156	64	2.438	inexperienced
7	tax-free	275	59	4.661	inexperienced
8	tax-free	217	84	2.583	inexperienced
9	tax-free	202	101	2.000	inexperienced
10	tax-free	189	75	2.520	experienced
11	tax-free	127	91	1.396	experienced
12	tax-free	184	76	2.421	experienced
13	tax-free	49	39	1.256	experienced
14	tax-free	157	79	1.987	experienced
15	tax-free	120	81	1.481	experienced
16	tax-free	268	91	2.945	experienced
17	tax-free	160	84	1.905	experienced
18	tax-free	231	91	2.538	experienced
19	tax-free	30	17	1.765	experienced
20	tax-free	58	33	1.758	experienced
21	tax-free	107	31	3.452	experienced
22	tax-free	114	62	1.839	experienced
23	tax-free	192	70	2.743	experienced
24	tax-free	73	32	2.281	experienced
25	tax-free	145	58	2.500	inexperienced
26	tax-free	105	53	1.981	inexperienced
27	tax-free	100	48	2.083	inexperienced
28	tax-free	219	105	2.086	inexperienced
29	tax-free	138	64	2.156	inexperienced
30	tax-free	25	17	1.471	inexperienced
31	tax-free	54	26	2.077	inexperienced
32	tax-free	141	108	1.306	inexperienced
33	tax-free	104	56	1.857	inexperienced
34	tax-free	52	40	1.300	inexperienced
35	tax-free	150	80	1.875	experienced
36	tax-free	200	94	2.128	experienced
37	tax-free	40	32	1.250	experienced
38	tax-free	122	53	2.302	experienced
39	tax-free	148	61	2.426	experienced

40	tax-free	37	14	2.643	experienced
41	tax-free	57	23	2.478	experienced
42	tax-free	92	50	1.840	experienced
43	tax-free	55	36	1.528	experienced
44	tax-free	146	67	2.179	experienced
45	tax-free	78	43	1.814	experienced
46	tax-free	100	71	1.408	experienced
47	tax-free	214	100	2.140	experienced
48	tax-free	217	94	2.309	experienced
49	tax-free	200	101	1.980	experienced
50	tax-free	201	67	3.000	experienced
51	tax-free	339	107	3.168	experienced
52	tax-free	306	118	2.593	experienced
53	tax-free	165	44	3.750	experienced
54	tax-free	55	28	1.964	experienced
55	tax-free	108	32	3.375	experienced
56	tax-free	288	60	4.800	experienced
57	tax-free	405	169	2.396	experienced
58	tax-free	217	114	1.904	experienced
59	tax-free	153	61	2.508	experienced
60	tax-free	189	51	3.706	experienced
61	25% tax	410	164	2.500	inexperienced
62	25% tax	150	53	2.830	inexperienced
63	25% tax	100	42	2.381	inexperienced
64	25% tax	308	122	2.525	inexperienced
65	25% tax	1174	312	3.763	experienced
66	25% tax	166	74	2.243	experienced
67	25% tax	132	47	2.809	experienced
68	25% tax	289	66	4.379	experienced
69	25% tax	145	50	2.900	experienced
70	25% tax	230	95	2.421	experienced
71	25% tax	215	61	3.525	experienced
72	25% tax	71	33	2.152	experienced
73	25% tax	218	125	1.744	experienced
74	25% tax	305	129	2.364	experienced
75	25% tax	19	13	1.462	not stated
76	25% tax	175	106	1.651	inexperienced
77	25% tax	432	113	3.823	inexperienced
78	25% tax	363	122	2.975	experienced
79	25% tax	38	16	2.375	experienced
80	25% tax	525	150	3.500	experienced
81	25% tax	1213	312	3.888	experienced
82	25% tax	144	64	2.250	experienced

83	25% tax	138	59	2.339	experienced
84	25% tax	333	109	3.055	experienced
85	25% tax	300	102	2.941	experienced
86	25% tax	151	65	2.323	experienced
87	25% tax	100	49	2.041	experienced
88	25% tax	188	94	2.000	experienced
89	25% tax	322	141	2.284	experienced
90	25% tax	160	77	2.078	experienced
91	25% tax	149	38	3.921	experienced
92	25% tax	63	17	3.706	experienced
93	25% tax	201	59	3.407	experienced
94	25% tax	21	14	1.500	experienced
95	25% tax	119	50	2.380	experienced
96	25% tax	151	66	2.288	experienced
97	50% tax	155	80	1.938	not stated
98	50% tax	173	60	2.883	not stated
99	50% tax	268	114	2.351	inexperienced
100	50% tax	120	58	2.069	inexperienced
101	50% tax	356	114	3.123	inexperienced
102	50% tax	100	43	2.326	inexperienced
103	50% tax	226	123	1.837	inexperienced
104	50% tax	269	92	2.924	inexperienced
105	50% tax	83	44	1.886	experienced
106	50% tax	233	72	3.236	experienced
107	50% tax	123	57	2.158	experienced
108	50% tax	200	69	2.899	experienced
109	50% tax	315	104	3.029	inexperienced
110	50% tax	332	119	2.790	inexperienced
111	50% tax	255	104	2.452	inexperienced
112	50% tax	131	66	1.985	inexperienced
113	50% tax	279	86	3.244	experienced
114	50% tax	182	66	2.758	experienced
115	50% tax	31	11	2.818	experienced
116	50% tax	62	23	2.696	experienced
117	50% tax	195	70	2.786	experienced
118	50% tax	175	74	2.365	experienced
119	50% tax	271	90	3.011	experienced
120	50% tax	143	44	3.250	experienced
121	50% tax	350	124	2.823	experienced
122	50% tax	245	81	3.025	experienced
123	50% tax	122	42	2.905	experienced
124	50% tax	182	79	2.304	experienced
125	50% tax	331	102	3.245	experienced

126	50% tax	179	91	1.967	experienced
127	50% tax	181	110	1.645	experienced
128	indirect (-)	113	53	2.132	inexperienced
129	indirect (-)	250	75	3.333	inexperienced
130	indirect (-)	112	50	2.240	inexperienced
131	indirect (-)	200	80	2.500	inexperienced
132	indirect (-)	197	82	2.402	inexperienced
133	indirect (-)	393	103	3.816	inexperienced
134	indirect (-)	226	79	2.861	inexperienced
135	indirect (-)	116	65	1.785	inexperienced
136	indirect (-)	200	95	2.105	experienced
137	indirect (-)	101	66	1.530	experienced
138	indirect (-)	150	56	2.679	experienced
139	indirect (-)	60	19	3.158	experienced
140	indirect (-)	100	47	2.128	experienced
141	indirect (-)	51	36	1.417	experienced
142	indirect (-)	240	61	3.934	inexperienced
143	indirect (-)	112	48	2.333	inexperienced
144	indirect (-)	120	43	2.791	inexperienced
145	indirect (-)	114	43	2.651	inexperienced
146	indirect (-)	200	67	2.985	inexperienced
147	indirect (-)	50	23	2.174	inexperienced
148	indirect (-)	222	81	2.741	inexperienced
149	indirect (-)	112	54	2.074	experienced
150	indirect (-)	100	41	2.439	experienced
151	indirect (-)	181	71	2.549	experienced
152	indirect (-)	135	37	3.649	experienced
153	indirect (-)	201	84	2.393	experienced
154	indirect (+)	124	46	2.696	not stated
155	indirect (+)	112	62	1.806	inexperienced
156	indirect (+)	347	188	1.846	inexperienced
157	indirect (+)	156	74	2.108	inexperienced
158	indirect (+)	92	51	1.804	experienced
159	indirect (+)	46	40	1.150	experienced
160	indirect (+)	186	84	2.214	experienced
161	indirect (+)	347	123	2.821	experienced
162	indirect (+)	104	63	1.651	experienced
163	indirect (+)	132	97	1.361	experienced
164	indirect (+)	128	60	2.133	experienced
165	indirect (+)	291	108	2.694	experienced
166	indirect (+)	233	77	3.026	experienced
167	indirect (+)	368	73	5.041	inexperienced
168	indirect (+)	186	62	3.000	inexperienced

169	indirect (+)	129	64	2.016	experienced
170	indirect (+)	191	86	2.221	experienced
171	indirect (+)	55	25	2.200	experienced
172	indirect (+)	200	93	2.151	experienced
173	indirect (+)	100	52	1.923	experienced
174	indirect (+)	112	44	2.545	experienced
175	indirect (+)	149	55	2.709	experienced
176	indirect (+)	167	61	2.738	experienced
177	indirect (+)	300	121	2.479	experienced
178	indirect (+)	183	88	2.080	experienced
179	indirect (+)	127	51	2.490	experienced
180	indirect (+)	118	81	1.457	experienced
181	indirect (+)	41	23	1.783	experienced
182	indirect (+)	166	94	1.766	experienced
183	direct (-)	150	67	2.239	inexperienced
184	direct (-)	200	65	3.077	inexperienced
185	direct (-)	285	136	2.096	inexperienced
186	direct (-)	121	53	2.283	inexperienced
187	direct (-)	234	54	4.333	inexperienced
188	direct (-)	141	55	2.564	inexperienced
189	direct (-)	150	64	2.344	inexperienced
190	direct (-)	146	52	2.808	inexperienced
191	direct (-)	350	140	2.500	inexperienced
192	direct (-)	133	63	2.111	experienced
193	direct (-)	127	79	1.608	experienced
194	direct (-)	115	51	2.255	experienced
195	direct (-)	71	34	2.088	experienced
196	direct (-)	148	73	2.027	experienced
197	direct (-)	101	93	1.086	experienced
198	direct (-)	197	66	2.985	experienced
199	direct (-)	142	44	3.227	experienced
200	direct (-)	197	89	2.213	experienced
201	direct (-)	316	78	4.051	experienced
202	direct (-)	134	68	1.971	experienced
203	direct (-)	120	78	1.538	not stated
204	direct (-)	100	39	2.564	inexperienced
205	direct (-)	181	74	2.446	experienced
206	direct (-)	256	93	2.753	experienced
207	direct (-)	115	68	1.691	experienced
208	direct (-)	306	119	2.571	experienced
209	direct (-)	60	31	1.935	experienced
210	direct (+)	66	38	1.737	not stated
211	direct (+)	320	137	2.336	not stated

212	direct (+)	322	143	2.252	not stated
213	direct (+)	60	30	2.000	inexperienced
214	direct (+)	220	72	3.056	inexperienced
215	direct (+)	180	64	2.813	inexperienced
216	direct (+)	229	97	2.361	inexperienced
217	direct (+)	204	93	2.194	inexperienced
218	direct (+)	229	99	2.313	inexperienced
219	direct (+)	245	105	2.333	inexperienced
220	direct (+)	100	49	2.041	inexperienced
221	direct (+)	66	49	1.347	experienced
222	direct (+)	138	47	2.936	experienced
223	direct (+)	60	27	2.222	experienced
224	direct (+)	52	30	1.733	experienced
225	direct (+)	42	27	1.556	experienced
226	direct (+)	189	95	1.989	experienced
227	direct (+)	118	56	2.107	not stated
228	direct (+)	231	122	1.893	inexperienced
229	direct (+)	60	40	1.500	inexperienced
230	direct (+)	307	135	2.274	inexperienced
231	direct (+)	80	61	1.311	inexperienced
232	direct (+)	690	238	2.899	inexperienced
233	direct (+)	259	109	2.376	inexperienced
234	direct (+)	222	73	3.041	inexperienced
235	direct (+)	243	102	2.382	experienced
236	direct (+)	110	57	1.930	experienced
237	direct (+)	41	21	1.952	experienced
238	direct (+)	42	21	2.000	experienced
239	direct (+)	46	34	1.353	experienced
240	direct (+)	131	63	2.079	experienced
241	direct (+)	40	28	1.429	experienced
242	direct (+)	99	24	4.125	experienced
243	direct (+)	41	16	2.563	experienced
244	direct (+)	41	19	2.158	experienced
245	direct (+)	147	51	2.882	experienced

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Otto von Guericke University Magdeburg
Faculty of Economics and Management
P.O. Box 4120 | 39016 Magdeburg | Germany

Tel.: +49 (0) 3 91 / 67-1 85 84
Fax: +49 (0) 3 91 / 67-1 21 20

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