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Perception of income tax rates: evidence from Germany

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Abstract Tax research mostly uses actual tax rates ("objective tax rates") to analyze and explain tax effects on taxpayers' decisions and tax distribution. In this study, we asked subjects to estimate how high their tax burden is, and to give their opinion if, or to what extent, they would consider this perceived tax rate as fair. We provide evidence that the perceived income tax rates significantly deviate from the objective tax rates for the majority of taxpayers. The degree of misperception can be partly explained by the individual's level of education, income, and whether the individual included social security contribution in their income tax rate estimation. Comparing the perceived tax rate with the tax rate that is regarded as fair, we find that the individual's level of education and age influence their estimate. Taking the results of Schmoelders (Das Irrationale in der öffentlichen Finanzwirtschaft. Rowohlt, Hamburg, 1960) into account, we show that the income tax misperception

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as well as the relation between perceived and fair income tax rates is surprisingly stable over time. The main distinction is that there is no more difference in tax perception between self-employed and employed people nowadays.

1 Introduction

Tax research has established several links between characteristics of a tax system, e.g. efficiency, horizontal equity, vertical tax burden distribution, procedural fairness and tax system integrity, and taxpayers' attitudes toward taxation that become manifest in tax morale, avoidance, compliance and resistance and furthermore in voting decisions (e.g. Lewis 1982; Kirchler 2007; Dubin 2012). However, there is a difference between actual ("objective") tax features and how these features are perceived by taxpayers (Schmoelders 2006, 166–168). Decisions are affected at the individual taxpayer's level. To measure, analyze and explain individual taxpayers' reactions to taxation, the concept of perceived ("subjective") tax features is appropriate. If nevertheless actual tax features are utilized to explain taxpayers' behavior, this has to be seen as a simplification with unknown and possibly severe consequences.

We focus on the perception of income tax rates: Tax rates have been shown to be a central characteristic of tax systems. Income tax rates cover individual tax perception as well as distributional fairness issues. We analyze the subjectively perceived tax burden and the determinants leading to the German taxpayers' evaluation. We use "perceived" income tax rates based on survey data as a measure for the subjective tax burden. We compare this measure to the legally effective "actual" tax rate, as well as a tax rate that is taken as fair ("fair income tax rate"). We can thus determine whether taxpayers were able to accurately estimate their actual tax burdens. Also, we analyze the individual taxpayer's statements regarding if, and to what extent, they feel that the tax burden that they perceived can be considered as fair.

Although it seems "appropriate that the study of public finance take seriously 'behaviorial' inconsistencies with traditional models of individual and collective decision-making" (Slemrod 2010), the vast majority of empirical tax studies are based on objective tax burdens. Only few studies attempt to measure or incorporate subjective loads. Looking at the relevant literature, we can basically identify two different methodic approaches. The first approach determines the subjective tax burden by way of interviews. We consider Schmoelders (1951, 1959a, b, 1960, 1970, 2006) to be the first researcher who measured the taxpayers' perception of the tax burden in Germany by using this approach. He comes to the conclusion that the perceived burden differs considerably among groups of professionals. For example, a high percentage of self-employed entrepreneurs, traders, and farmers ("business

entrepreneurs") overestimated their tax burden (Schmoelders 1960, 86). In other groups (salaried staff, non-salaried staff and civil servants), the majority of interviewees accurately estimated or even underestimated their tax load. Hundsdoerfer and Sichtmann (2009) also interviewed taxpayers in order to assess if especially self-employed physicians were able to accurately estimate their marginal tax rate. One-fourth of the interviewed self-employed physicians provided marginal tax rates that were not possible under the applicable tax laws, indicating that they didn't know their relevant marginal tax rate at all. However, comparing the average estimated marginal tax rate and the average marginal tax rate derived from the 1998 wage and income tax statistics, there was no significant difference between peoples' estimates and the actual statistical value (Hundsdoerfer and Sichtmann 2009, 28). There are further tax perception studies for Germany based on the socio-economic panel (SOEP). E.g. Liebig et al. (2010) address the perception of income fairness and figure out that perception is not affected by taxes.

The second type of literature derives the perceived tax burden from observations. This part of the literature primarily focuses on economic studies regarding work-leisure decisions of taxpayers.[1] The labor supply (measured as working hours) is explained by the neo-classical labor supply model. By introducing a perception parameter for the marginal tax rate, one can determine whether and to which extent individuals are rationally conscious of the marginal tax rate.

Table 1 shows an overview of the results. In none of these studies taxpayers were able to correctly estimate their actual income tax payments or the marginal tax rate. The studies identify the following determinants to influence the taxpayers' awareness regarding their own marginal tax rate: education, employment in the financial sector, experience with investment decisions, age, income, as well as demand for tax and investment consulting services. Yet the studies come to different results regarding to what extent these impacts are able to explain the phenomena. Whereas Gensemer et al. (1965) find that education has a positive impact on the accuracy of people's estimations, Fujii and Hawley (1988) did not find a clear connection. Furthermore, Rupert and Fischer (1995) did not find any relation between the subjects' knowledge of the tax laws and the quality of their estimates. Except for Lewis (1978), none of the studies mentioned above investigated the relation between the perceived burden and the burden perceived as fair.

Economic psychology and fiscal sociology have extensively discussed the determinants of tax compliance. Fairness perceptions have turned out to contribute to the explanation of tax compliance behavior (e.g. Kirchler 1998; Kirchler et al. 2003). According to Pommerehne and Frey (1992), tax compliance increases if taxpayers feel that they receive adequate public services in exchange. Alm et al. (1999) model tax compliance behaviour as a social norm because taxpayer's perceptions on the compliance behaviour of others influence compliance behaviour. Feld and Frey (2007) argue that tax compliance is based on a psychological tax contract that

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[1] The results are heterogeneous. While Rosen (1976a, b) in respect to the United States and Brännäs and Karlsson (1996) in respect to Sweden found that the marginal tax rate is accurately estimated, König et al. (1995) in respect to Germany found that there is an underestimation and Arrazola et al. (2000) in respect to Spain found that there is an overestimation of the marginal tax rate. Furthermore, Fochmann et al. (2013) found a net wage illusion regarding the work-leisure decision for German tax payers.

Table 1 Overview of the structure and findings of international studies regarding perceived tax burdens

Paper	Dependent variable	Explanatory variable(s)	Findings	Sample
Enrick (1963, 1964), USA	Degree of misperception of the actually paid taxes in the most recent tax return	–	Tax payments are usually underestimated. No confirmation of a potential fiscal illusion regarding withholding taxes	772 (1963) 500 additional sample (1964)
Gensemer et al. (1965), USA	Degree of misperception of the personal marginal tax rate (rough classification of the actual marginal tax rate)	Income, profession, education, religion, investment activities, working hours per week, size of the place of birth, age, political views, varying income, gifts received, volunteering, size of the portfolio, unrealized capital gains, size of the place of residence, possible additional sources of income	The majority of the taxpayers do not know their marginal tax rate. Relevant factors affecting the estimation: income, education, profession and pursued investment activities	957 (subjects with a gross income > 10,000 USD)
Fujii and Hawley (1988), USA	Degree of misperception of the personal marginal tax rate	Privately owned home, age, sex, years of school education, number of members of the household	Overall, an average underestimation by 3 %. Sex, education and size of the household do not have any significant impact. Older persons and home-owners tend to underestimate their marginal tax rate	2,092
Rupert and Fischer (1995), USA	Degree of misperception of the personal marginal tax rate	Degree of familiarity with the tax system, assisted by investment consultants, income, additional factors of the tax return such as donations, refunds or subsequent payments after most recent tax return, assisted by tax consultant	On average, the marginal tax rate was over-estimated. 3 variables are significant. The higher the income, the more accurate the estimation; subjects made less accurate estimations when demanding tax consulting services and more accurate estimations when demanding investment consulting services	108

Table 1 continued

Paper	Dependent variable	Explanatory variable(s)	Findings	Sample
Lewis (1978), Great Britain	Degree of misperception of the marginal tax rate of certain classes of income. Marginal tax rate regarded as fair	Income, profession, age, member of a party	Underestimation of the marginal tax rate. The rates regarded as fair are even lower. Relevant factors affecting the estimation: Marginal tax rate regarded as Income, profession and age. Whether a subject is a member of a party did not have any impact on the estimation, but rather the willingness to vote	200
Auld (1979), Canada	Difference between the average tax due payable in various income groups and the amount that the subjects believed they actually paid	Income	Between 0 and 9,999 $, the average tax paid is overestimated. Between 10,000 and 19,999 $, the tax payment is slightly underestimated. Over 20,000 $, the tax payment is highly underestimated	630

establishes a fair, reciprocal exchange between taxpayers and the government. Braithwaite (2002) relates tax compliance to tax system integrity, i.e. the capacity of a government not only to deliver goods and services, but also to safeguard sound, respectful governance and democracy. Braithwaite (2004) shows for the example of Australia that the view that the privileged are failing to pay their fair tax share is explained by economic self-interest, disillusionment with the democracy, procedural justice perceptions concerning the Tax Office and general values. The perceived compliance of other taxpayers has been shown to influence compliance behavior (Torgler and Schneider 2005). According to Hartner-Tiefenthaler et al. (2012), perceived distributive fairness (of EU transfer payments) affects EU-tax compliance behavior. Wenzel (2003) and Hofmann et al. (2008) discuss how knowledge of taxation and fairness (distributive, procedural and retributive justice) are related to tax compliance behavior. This line of research is reviewed by Kirchler (2007, 83).

Like Schmoelders (1960) and Lewis (1978), we are interested in both the amount of the perceived tax burden and the correlation between the perceived tax burden and the burden deemed as fair. Fifty years after Schmoelders' study (1960) it is not clear whether its findings are still valid nowadays. We expand Schmoelder's article by including the factors affecting the perceived and the fair tax burden.

Our approach has a long tradition in fiscal psychology research. It was introduced by Schmoelders (1960). Half a century after his measurement of perceived tax burdens, we would have expected that—considering several important legal and economic developments, among it a quintupled GDP per capita, the German reunification, the financial crisis and several tax reforms, and taking into account that taxpayers have gained some 50 years of experience with the income tax system[2]—the relation between perceived and actual tax burdens has changed. However, and somewhat surprisingly, we find by and large no change in the gap between perceived and actual tax burdens, though the difference in tax perception between self-employed and employed people reported by Schmoelders (1960) seems to have vanished. We see our main contribution in showing that the income tax misperception as well as the relation between perceived and fair income tax rates is surprisingly stable over time.

2 Data collection, method and sample

This project was part of a study performed on behalf of the German Federal Ministry of Finance.[3] The data was collected by trained interviewers performing standardized individual interviews.[4] The interviewers selected subjects that were in

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[2] Since the tax reform 1958 the basic structure of the German income tax tariff is almost the same. Thus, one should expect that taxpayers' familiarity with the tax rate structure should have been increased over time.

[3] For a description of the results concerning tax rate perception in German language see Blaufus et al. (2010).

[4] Although the German socio-economic panel (SOEP) provides data on tax perception in Germany, collecting own data was inevitable. SOEP data is not about the perception of actual tax rates but rather on the perception of income fairness. Moreover we are interested in the perception of the whole income tax tariff, while SOEP only covers perception of own income.

gainful employment[5] due to the fact that these subjects incurred taxes and were thus familiar with the German tax system. Subjects were selected based on a quota plan that proportionally corresponded to the overall working population with respect to the socio-demographic characteristics sex, age, education, and amount of income.[6] A total of 1,009 subjects was interviewed. Statistical tests were performed in order to ensure that the specifications set forth in the quota plan were met. With an error level of 5 %, no significant deviations between the sample and the population could be identified.

3 Absolute perceived tax burden

3.1 Measurement

In order to measure the perceived average tax rate (perceived ATR) and the perceived marginal tax rate (perceived MTR), the subjects were asked the following questions:

1. How high do you rate the income tax burden of an unmarried person in percent of the respective annual income?
   (EUR 10,000, EUR 40,000, EUR 300,000 and EUR 2 million)
2. Assuming that your own gross income increases by EUR 100 per month next year, what is the additional income tax in EUR that you would have to pay (excl. social security contributions)?

While the first question aimed at assessing the perceived ATR, the second question aimed at assessing the perceived MTR. Note, that the perceived ATR is based on four pre-defined income categories, whereas the perceived MTR refers to the subjects' own income. This procedure has the disadvantage that we could not observe the perceived ATR at the subjects' actual income. However, it allows us to study the perceived progression of the tax rate function. Both questions were exclusively based on the income tax burden. In order to investigate whether the subjects mixed up tax payments and social security contributions in their estimates or provided an estimate that comprises both the tax payments and the social security contributions, they were asked—after the first question—whether they included social security contributions in their estimates.

The majority (588 of 1,009) did not include social security contributions in their income tax estimate. Thus, these subjects are able to distinguish between taxes and social security contributions. This is in line with results from Hundsdoerfer et al. (2013) who show that the willingness to pay a health insurance premium is higher than the willingness to pay an income tax. Our results in conjunction with Hundsdoerfer et al. (2013) show that social security systems that are financed by

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[5] Subjects in gainful employment in this survey included workers, civil servants, and self-employed entrepreneurs: short interruptions of the employment, e.g. due to parental leave, maternity leave, etc., did not exclude people from being selected.

[6] Frequencies were derived from the 2008 Statistical Yearbook published by the German Federal Statistical Office.

explicit taxes (e.g. the Scandinacian system) may lead to a higher perceived tax burden. While such systems may reduce costs and complexity of tax collection, the potential drawback of higher perceived tax burdens should be kept in mind.

However, one-fourth (260 of 1,009) of the subjects included social security contributions. 161 subjects were not sure about whether their estimates included social security contributions. We conducted several logistic regressions in order to investigate the reasons for including or not including social security contributions. The results showed that there was no significant systematic difference in any of the investigated characteristics (age, sex, workplace, monthly net income, school education, self-employed/employed, marital status, children, and knowledge of tax laws) between individuals that distinguished between taxes and social security contributions and such who did not.[7] However, systematic differences were identified between individuals that did not know the difference between taxes and social security contributions ("not sure") and all other subjects. We found that individuals with a lower income (highly significant[8]), less knowledge of the tax laws (highly significant), and also a lower school degree (weakly significant) were not able to distinguish the payments.

3.2 Perceived average and marginal tax rates

The perceived average tax rates are outlined in Table 2.

Only for a given income of EUR 10,000, subjects significantly overestimated the actual tax burden. On average, they estimated the tax burden at 14.8 %, which significantly exceeded the actual value (4.0 %).[9] One explanation for such an overestimation could be that the subjects did not take the basic tax allowance (amounting to EUR 7,664) into account. For an income of EUR 40,000, the perceived ATR basically equals the actual ATR.[10] For the higher income classes of EUR 300,000 and EUR 2 million, the subjects significantly underestimated the actual tax burden.[11]

Below, the subjects are divided into three groups depending on whether their perceived tax burden corresponded to their actual tax burden or whether they over- or underestimated the tax burden. For this classification, we assume that the perceived tax burden more or less equals the actual tax burden, if it does not deviate from the

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[7] We intentionally did not distinguish between Eastern and Western German subjects. The majority of the subjects was from the Berlin/Brandenburg metropolitan area. Given the "mixed" Eastern/Western socialization and employment biographies—in particular in this metropolitan area—we did not consider this distinction useful 20 years after the wall came down (see Brosig-Koch et al. 2011).

[8] In the following we use the term (highly, weak) significant for significance at the (1, 10) 5 % confidence level.

[9] The statistical significance was verified by a one-sample t test that resulted in a p value of 0.000.

[10] There is no significant difference between the perceived and the actual tax burden for those who did not include social security contributions in their estimation (one-sample t test, $p = 0.659$). Those who included social security contributions in their tax estimate overestimated their actual tax burden (one-sample t test, $p = 0.000$); thus, the total tax burden was slightly overestimated (one-sample t test, $p = 0.000$).

[11] A one-sample t test results in a p value of 0.000 both at EUR 300,000 income and EUR 2 million income.

Table 2 Perceived average income tax rates

Did you include social security contributions in your estimates?	Perceived ATR (in %) for a taxable income of			
	EUR 10,000	EUR 40,000	EUR 300,000	EUR 2,000,000
For comparison: actual average income tax rate (Germany, 2008)	4.0	23.1	39.9	44.2
No (N = 588)				
Mean	13.0	22.9	33.4	39.2
Median	10.0	22.0	35.0	42.0
Standard deviation	11.7	11.1	13.4	14.7
Yes (N = 260)				
Mean	18.6	29.8	39.6	44.1
Median	20.0	30.0	40.0	45.0
Standard deviation	13.6	10.9	11.2	12.6
Not sure (N = 161)				
Mean	15.0	23.6	31.9	38.0
Median	10.0	22.0	33.0	40.0
Standard deviation	11.8	12.0	13.6	17.1
Total (N = 1009)				
Mean	14.8	24.8	34.7	40.3
Median	11.0	25.0	37.0	45.0
Standard deviation	12.5	11.6	13.2	14.8

Table 3 Comparison of actual and perceived average tax burden

Income category (in EUR)	Percentage of subjects with		
	Perceived ATR < actual ATR	Perceived ATR = actual ATR	Perceived ATR > actual ATR
10,000	–	49.7	50.4
40,000	28.8	45.6	25.6
300,000	41.6	39.8	18.5
2,000,000	33.1	53.1	13.8

actual tax burden by ±5 percentage points. It is remarkable that almost all subjects provided percentages that could be divided by 5. Therefore, also the actual burden is rounded up to a percentage that can be divided by 5. For example, the actual tax burden on income of EUR 40,000 is 23.1 %. In this case, we would round up this percentage to 25 %, so that all rates between 20 and 30 % would be classified as roughly equalling the actual burden. Accordingly, the respective tax burden relating to EUR 10,000, EUR 300,000, and EUR 2 million (4.0, 39.9 and 44.2 %) is rounded up to 5, 40, and 45 %, respectively. Table 3 shows the results.

This shows that a considerable portion of the subjects (approx. 47 % (33.1 + 13.8 %) to 60 % (41.6 + 18.5 %) depending on the class of income)

estimates a tax burden that considerably deviates from the actual burden. Even for an income level of EUR 40,000 for which the average perceived burden roughly equals the actual tax burden, there are substantial deviations between the perceived and the actual burden. Every estimate deviates from the actual burden by more than 5 percentage points. Downward and upward deviations merely even out on average. Also, Table 3 shows that for income levels of EUR 40,000 and higher, there were always more interviewees who estimated the tax burden to be lower than the actual burden, than interviewees who overestimated it.

The taxpayers' answers regarding their own marginal tax rate confirm these results. We asked subjects about their monthly net income (recorded in four pre-defined classes of income)[12] and other parameters (age, marital status, obligation to pay social security contributions, number of exempted children's allowances and—if any—the spouse's obligation to pay social security contributions and income). For practical reasons, we assumed that the individuals were not subject to church tax.[13] Based on this data we calculated taxable incomes for each subject that corresponds with the lower and the upper bound of the subject's net income category.[14] This procedure seems, particularly, appropriate for non-filers (26.3 % of the sample). For those taxpayers who have itemized deductions above the standard deduction we potentially overestimate the actual marginal tax rates. Hence, the number of subjects that underestimate their own marginal tax rate may even be higher in reality. This applies, especially, for high income earners due to the positive relation between deductions and income. It is important to note, that this would further support our result that subjects with higher income underestimate their marginal tax rate more often.

A range for the actual MTR was derived from the upper and the lower values. If the perceived MTR was within this range, we assumed it to equal the actual MTR.

The results show that the majority of the subjects does not know their own marginal tax rate. Only one out of three subject provides an estimate that coincides with the actual tax burden. The other aspects that we mentioned above when describing the results for ATR can be applied accordingly for the analysis of the MTR: Interviewees tend to underestimate the marginal tax rate for higher income levels. Table 4 shows a detailed overview.

3.3 Analysis of explanatory variables

We described above that the subjects, on average, overestimated both the ATR and the MTR at lower income levels and underestimated them at higher income levels.

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[12] The four pre-defined classes of monthly net income are (in EUR): Less than 1,000; 1,000–2,000; 2,000–3,000; more than 3,000.

[13] Note that not accounting for church tax leads to lower tax rates. The majority of the subjects underestimated their own tax rates which are calculated without considering church tax. By incorporating church tax, the number of subjects that underestimated their own tax rates would rather increase.

[14] We use standard deductions for our calculations and assume joint assessment in case of married couples. For each given net income we calculate the taxable income by solving the following two equations:

taxable income = pre-tax income − standard deductions

pre-tax income − social security contributions − income taxes = post-tax income.

Table 4 Comparison of actual and perceived marginal tax burden

Personal income (in EUR/year)	Percentage of subjects with		
	Perceived MTR < actual MTR	Perceived MTR = actual MTR	Perceived MTR > actual MTR
<15.000	0.0	52.1	47.9
15,001–30,000	29.6	30.9	39.4
30,001–45,000	17.5	52.5	30.0
45,001–60,000	48.0	25.7	26.4
60,001–75,000	44.6	31.1	24.3
>75,000	58.6	24.1	17.2

Now we turn to the reasons for such inaccurate estimations. One reason for the underestimation of the MTR could be that the subjects were not able to correctly distinguish between MTR and ATR (see de Bartolome 1995). However, only 17 % of the total sample provided estimations that clearly[15] equaled their own actual ATR. Regarding only subjects which underestimate their own marginal tax rate (roughly one-third), most subjects (54 %) provide tax rates that clearly equal their ATR. This could be an indication that some of the subjects mixed up marginal and average tax rates.[16] In order to identify additional factors explaining the deviation of the perceived from the actual ATR[17]/MTR we conducted multinomial logistic regressions that contain the following explanatory variables:

1. *Education* We anticipate that the degree of education—operationalized by the school diploma obtained—positively affects the probability that the perceived tax burden equals the actual tax burden. Hence, we anticipate that the higher the subject's degree, the better he or she will be able to apply the relevant information (tax laws, tax assessment notes, pay slip, etc.).
2. *Age* We anticipate that the older the subject is, the more experience the subject has with the tax system. Thus, the subject's age positively affects the probability that the perceived tax burden equals the actual tax burden.
3. *Profession* We anticipate that, due to the monthly pay slips that lead to an increased salience of the tax burden, being employed positively affects the probability that the perceived tax burden equals their actual tax burden.

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[15] The estimation of the subject's own marginal tax rate is within the range of average tax rates that we estimated but not within the range of marginal tax rates.

[16] We asked the participants for ATR based on given taxable income categories. One could argue that subjects think of gross instead of taxable income. Since gross income normally exceeds taxable income, this would result in higher estimations of the tax rate. However, most subjects underestimated the actual tax burden. In this case, mixing up gross and taxable income diminishes deviations.

[17] As mentioned above, we do not observe the ATR for the subjects own income level, but rather for the pre-defined income categories. Concerning the perceived ATR, we present the results for the pre-defined income of EUR 40,000. This income is slightly higher than the average annual income in Germany. The presented results do not depend on the chosen income as robustness checks for the other income categories show (see Table 10 in Appendix).

Table 5 Name, description and parameters of the explanatory variables

Name	Description	Parameters
Degree of education	At least college/university degree	0: no; 1: yes
Age	Age in years	Metric
Profession	Subject is an self-employed business entrepreneur	0: no; 1: yes
Sex	Subject's sex	0: female; 1: male
Social security contributions	The estimated average income tax burden includes social security contributions	0: not sure; 1: yes; 2: no
Income	Taxable income	Metric
Income roughly EUR 10,000	Taxable income ranges between 0 and 20,000 EUR	0: no; 1: yes
Income roughly EUR 40,000	Taxable income ranges between 30,000 and 50,000 EUR	0: no; 1: yes
Marital status	Subject is married	0: no; 1: yes

4. *Income* We anticipate that the income has a positive impact on the probability of the perceived tax burden to equal the actual tax burden. This is due to the fact that the higher the income, the better the rewards from tax planning, and thus the more attractive it becomes to learn more about tax laws.

We included the interviewee's gender, the marital-status, and a dummy variable which indicated if social security contributions were considered when estimating the tax burden. For estimating the model concerning the ATR we, additionally, took into account the degree to which the own income equaled the pre-defined income category of EUR 40,000. Table 5 shows an overview of the variables in our study.

Each dependent variable is nominal and takes one of these values[18]:

- The perceived ATR/MTR is lower than the actual ATR/MTR.
- The perceived ATR/MTR (roughly) equals the actual ATR/MTR.
- The perceived ATR/MTR exceeds the actual ATR/MTR.

From Table 6 we derive the following results:

1. *Education* The level of education decreases the probability that the perceived and the actual tax rate deviate—both when estimating the average tax rate and the marginal tax rate. However, in the model that include the perceived ATR (MTR), only a significant effect on underestimation (overestimation) can be determined. For example, in estimating the ATR, a subject who does not have a university-entrance diploma is about 2 times more likely to underestimate the actual tax burden than a subject who does have such a diploma. Overall, the hypothesis is confirmed.
2. *Age* According to our hypothesis, the probability for different perceived and actual tax rate decreases, if the subject is older. While we do not find significance in the models that include the perceived ATR, the probability that

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[18] For information regarding operationalization see Sect. 4.2.

Table 6 Results of the multinomial regressions: ATR/MTR misperception

	ATR (income category = 40,000 €)		MTR (based on own income)	
	Under-estimation	Over-estimation	Under-estimation	Over-estimation
Constant	0.027	−0.357	−1.631***	−0.408
University-entrance dipl.	−0.823***	−0.257	−0.088	−0.364**
Age	−0.007	−0.011	−0.001	0.014**
Self-employed	0.443**	−0.055	0.364	0.080
Male	0.176	0.440***	−0.211	−0.131
Incl. soc. sec. contr.	−0.881***	0.695***	−0.320	−0.365**
Income (in EUR 10,000)	0.005	−0.043	0.327***	−0.054
Income close to EUR 40,000	0.201	0.052		
Nagelkerke-R^2		0.107		0.168

* Significant at the 1 % level of confidence

** Significant at the 5 % level of confidence

*** Significant at the 1 % level of confidence

the subjects overestimate their own marginal tax rates increases significantly which is clearly a contradiction to our hypothesis. Hence, the hypothesis is not confirmed.

3. *Profession (self-employed/employed)* In Schmoelders' study (Schmoelders 1960) profession was the variable with the most explanatory power concerning the deviation of the perceived and the actual tax burden. Our results only show systematic differences for the underestimation of the ATR. In this case, there was a 56 % higher chance that the self-employed subjects underestimate their actual tax rate—which is contrary to the findings of Schmoelders.

4. *Income* Contrary to our hypothesis, in the model that explains the ATR perception the income level did not have a significant effect. Moreover, the higher the income the higher the probability that the subjects underestimated their marginal tax rate (highly significant).

In our models "including social security contributions" has the most explanatory power, followed by income (ATR) and age (MTR) respectively.

Subjects who did not make the distinction between income tax and social security contributions were 1.2 times more likely to overestimate the ATR, but they faced only 40 % of the risk to underestimate the ATR, compared to subjects who did make the distinction. Accordingly, about 73 % of the interviewees that did not distinguish between income tax and social security contributions overestimated the ATR. These subjects take social security contributions as taxes and thus have a higher perceived tax burden.

We could not identify any general effect of the control variable gender. However, the results allow the assumption that the probability that a man overestimates (underestimates) the ATR is higher (lower) than the probability that a woman overestimates (underestimates) the ATR. In fact, the probability that a man's

perceived average tax rate exceeds the actual tax rate is significantly higher than the probability that a woman's perceived ATR exceeds the actual ATR (55 % higher).

Finally, we took the degree to which the interviewees' income could be attributed to the pre-defined income as a third control variable. Since perceived ATR was only available for the pre-defined income category, we investigated if the perceived ATR depends on whether the subject had a similar income. Table 6 shows that the degree of accordance of the taxpayers' income to the pre-defined category did not have any impact on the deviation probability.

4 (Relative) perceived tax burden

4.1 Measuring the fair tax burden

In addition to the perceived tax burden we investigated the relation between the perceived and the fair tax burden, i.e. the tax burden a taxpayer would perceive as fair regarding his income level. The reason is that we assume that individuals usually do not base their opinions and decisions on absolute parameters but rather on deviations between the absolute parameters and a reference parameter.[19] If we project this idea to the perceived tax burden, the individual reference parameter could describe the fair tax burden. In order to measure the fair tax burden, we asked the following question regarding the perceived tax burden:

> Which income tax in percent of the respective annual incomes (EUR 10,000, EUR 40,000, EUR 300,000 and EUR 2 million) of an unmarried person do you consider fair?

Here, the interviewer repeated the estimated average tax rates provided by the subjects for each income category. Hence, the subjects used their own perceived average tax rates as an anchor for the tax burden they perceived as fair. We calculated the logarithm of the perceived and fair burden ratio as in Jasso (1980) in order to measure the tax burden regarded as fair ("relative perceived tax burden"):

$$J = ln\left[\frac{\text{perceivedATR}}{\text{fairATR}}\right]. \tag{1}$$

If $J = 0$, perceived ATR equals fair ATR which means that the subject takes their perceived tax burden as fair. If $J > 0\,(J < 0)$, the subjects find their perceived tax burden too high (too low). The selected valuation function also implies that positive deviations from the tax burden perceived as fair weigh stronger than negative deviations.[20]

4.2 Evaluating the fairness of the perceived tax burden

The results are summarized in Table 7. We can see that the fair tax rate, on average, is progressive. When analyzing the information provided by each individual, it

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[19] Kahneman and Tversky (1979), Hogarth and Einhorn (1992).

[20] Such valuation corresponds to the value function as in Prospect Theory, see Kahneman and Tversky (1979).

Table 7 Fair and relative perceived average tax burden

	Income (EUR/year)			
	10,000	40,000	300,000	2,000,000
Fair ATR in %	6.5 (7.7)	15.8 (9.2)	30.5 (13.6)	41.1 (15.5)
Perceived burden (relative)	3.2 (5.8)	0.8 (2.1)	0.2 (0.5)	−0.1 (1.5)

shows that 72 % of the subjects prefer a constant progressive tax function and 22 % prefer a primarily progressive tax function which in some income groups shows constant average tax rates. However, 6 % of the subjects believe that a proportional or regressive tax rate is fair.[21]

Furthermore, Table 7 shows that the perceived ATR at income levels of EUR 10,000, EUR 40,000, and EUR 300,000, respectively, was considered too high on average, while the ATR at the EUR 2 million income was considered too low (if only to a slight extent).[22] Overall, the relative perceived tax burden is highest at an income level of EUR 10,000, and decreases with the income increasing. That means, the income tax burden is regarded as unreasonably high, especially in the lower income segments. It is notable that, for an income of EUR 10,000, the interviewees perceive a tax rate as fair which is on average higher than the actual tax burden[23]; in all other cases, the fair burden is lower than the actual tax burden, even at an income of EUR 2 million. Comparing the fair tax burden with the actual tax burden, on the one hand, and with the perceived tax burden, on the other hand, we come to different conclusions. Compared to the perceived tax burden (relative perceived tax burden), the tax burden at an income of EUR 10,000 is perceived as too high and at an income of EUR 2 million as too low, whereas the comparison of the actual and the fair burden shows an exact opposite trend. Hence, it makes a major difference whether tax policies are based on the perceived or the actual tax burden. Figure 1 summarizes our findings.

4.3 Analysis of explanatory variables

We want to understand whether there are systematic individual differences in the perception of fair tax rates. Thus we divided the subjects into three groups: The first group perceives the tax burden as too low, the second group perceives it as fair, and the third group perceives it as too high. According to Table 8, only 16 % of the subjects perceive the tax burden as fair. However, the (absolute) majority of the subjects perceives the tax burden as too high.

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[21] Please note that we did not ask the subjects about the amount of taxes paid, but about relative tax rates. This may have caused results which show a stronger preference of a progressive tax scale. See McCaffery and Baron (2003).

[22] The differences between the perceived ATR and the fair ATR are highly significant in the first three income categories (two-sample t test for combined samples, $p = 0$). In the EUR 2 million income group, this difference is only weakly significant ($p = 0.091$).

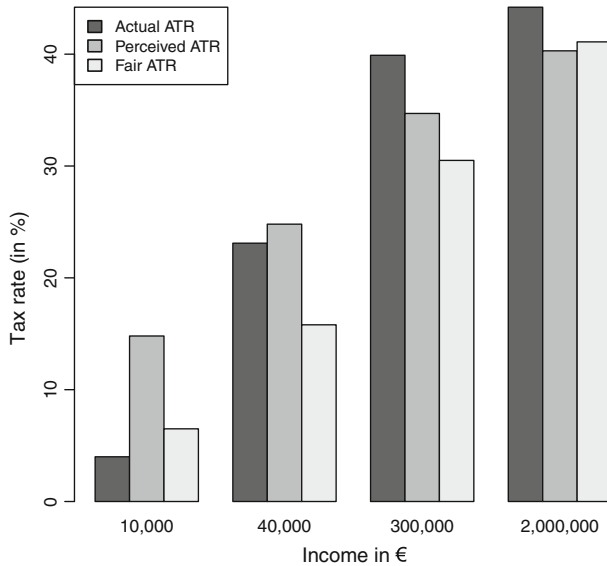[23] The fair burden totals 6.5%, while the actual tax burden is only 4%.

Fig. 1 Actual, perceived and fair average tax rates

Table 8 Relative perceived burden (income category = 40,000 €)

(Relative) perceived burden	Group percentage per income in %
Too low	5.1
Too high	78.7
Reasonable	16.3

Table 9 shows the results of the multinomial logistic regression.[24] Two highly significant factors can be identified that affect the perceived tax burden:

1. The probability that the perceived tax burden is considered as unfairly high decreases the older the subject is. The (relative) perceived burden is therefore particularly high at the group of younger employees. The chance that a 20-year old perceives a tax burden as too high is twice as high as the chance that a 50-year old does.
2. The probability that the perceived burden is regarded as fair increases, if the interviewed employee has a higher education (university-entrance diploma or college or university degree). The chance that a subject without university-entrance diploma perceives the tax burden as unfair is up to 1.2 times higher than the chance that a subject with university-entrance diploma does.

Education predominates age, while income, profession (self-employed, employed), sex, marital status and the degree to which the income fits in the pre-

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[24] We present the results for the pre-defined income of EUR 40,000. The presented results do not depend on the chosen income category as robustness checks for the other income categories show (see Table 11 in Appendix).

Table 9 Results of the multinomial regressions: relative perceived tax burden (income category = 40,000 €)

Burden	Too low	Too high
Constant	−0.107	2.286***
University-entrance diploma	−0.797**	−0.431**
Age	−0.014	−0.017**
Self-employed	−0.006	0.037
Marital status	−0.063	0.391*
Male	0.034	−0.023
Income (in EUR 10,000)	−0.065	−0.003
Income close to EUR 10,000	−0.221	0.108
Income close to EUR 40,000	0.284	−0.015
Nagelkerke-R^2	0.024	

* Significant at the 1 % level of confidence

** Significant at the 5 % level of confidence

*** Significant at the 1 % level of confidence

defined category do not have any systematic impact on the relative perceived tax burden. Similar to the absolute perceived burden, this analysis shows a major difference to Schmoelders (1960). While in Schmoelders' study, the type of employment (self-employed/employed) was the most significant factor, it does no longer have any systematical impact 50 years later. Another interesting fact is that there are no indications of an egoistic bias when it comes to evaluating equality aspects. It is often argued that the perceived fairness of income tax rates could be affected by self-serving bias motives (see e.g. Seidl and Traub 2001, 262). According to this argument, taxpayers do not necessarily classify the (vertical) justice of the income tax rate by using the ability-to-pay-principle, but rather based on the device "Everything is fair as long as I benefit from it." ' Hence, subjects whose own income is close to the pre-defined income should have a significantly higher (relative) perceived tax burden than the other subjects. However, this is not the case. In addition, according to the "self-serving bias" theory, primarily subjects with a lower income should be interested in redistribution. This would mean that in particular this group would have a negative (relative) perceived tax burden when being asked about high income. We could not identify any such impact from the results in Table 9. We conducted several robustness checks that all confirmed this result. In particular, we conducted multivariate analyses to examine the relation between income and perceived fairness as well as the relation between income and the perceived progression of the tax rate function. In both there is no evidence for self-serving bias.

5 Summary

Fifty years ago, Schmoelders (1960) pointed out how important the subjective tax burden was for tax policies. In his 1958 survey he showed that only one-third of the interviewed subjects knew their actual tax burden. However, economic tax research has continued to use almost exclusively actual tax rates when analyzing the effects of taxes on tax distribution decisions. The initial motivation of our study was to examine whether 50 years later the results of Schmoelders are still valid. Moreover, we expand his work by analyzing the determinants of the perceived and the fair tax burden in more detail. For this purpose, more than 1,000 employed and self-employed people were interviewed.

Somehow surprisingly, considering several important legal and economic developments and taking into account that taxpayers have gained some 50 years of experience with the income tax system, we find that Schmoelders' results are quite robust over time. The results show that the majority of subjects doesn't even approximately estimate the actual marginal or average tax rates. If we classify the subjects' estimated tax rates as perceived tax rates, the perceived tax burdens significantly deviate from the actual tax burdens for most individuals. Subjects, on average, overestimated both the ATR and the MTR at lower income levels and underestimated them at higher income levels. Interestingly, as Schmoelders (1959b) pointed out this corresponds to the so-called Cambridge Rule (Dalton 1967, 34): "The rich should pay more taxation than they think, while the poor should think they pay more than they do. This double illusion it is argued, will keep the rich contented and the poor virtuous, and will tend to maximise work and saving by all classes." The most significant factors leading to a deviation of the perceived tax burden from the actual tax burden were the taxpayers' education and whether they included social security contributions in their estimations. The higher the education, the higher the probability that the actual tax burden was accurately estimated. Thus, our results hint at a substantial degree of fiscal illusion (Puviani 1960) at least for less educated taxpayers. In addition, subjects who did not distinguish between taxes and social security contributions were more likely to overestimate the tax burden than those who did.

The comparison of the perceived tax burden and the tax burden regarded as fair ("relative perceived tax burden") showed that subjects considered the tax burden as too high for an income of EUR 300,000 or lower, while they considered the tax burden as too low for an income of EUR 2 million. The most remarkable aspect is the discrepancy of the tax burden that is regarded as fair compared to the perceived tax burden, on the one hand, and to the actual burden, on the other hand. While the latter implies that the taxpayers believe it is fair to decrease (increase) the taxes on an income of EUR 10,000 (EUR 2 million), the opposite trend is found in the first case. The tax burden perceived as fair on an income of EUR 10,000 (EUR 2 million) significantly exceeds (is significantly lower than) the actual tax burden. Hence, it is of major importance whether recommendations regarding tax policies are based on the individuals' perceived or the actual tax burden.

Analyzing the determinants, we can see that the valuation whether the tax burden is considered fair strongly depends on the subjects' education and age. Accordingly, the higher the education, the higher the probability that the subject perceives the tax rate as fair. Age affects the perception to the extent that younger subjects in particular perceive the tax burden as too high. This may explain the fact that numerous studies regarding tax evasion show that particularly young taxpayers tend to evade taxes (e.g. Richardson 2006).[25]

The main distinction to Schmoelders' findings is that there is no more difference in tax perception between self-employed and employed people nowadays. This is particularly important, as it is known from the literature that the noncompliance rate

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[25] "The chronological age of taxpayers is one of the most important determinants of tax evasion (…). Studies find that older taxpayers are generally more compliant than younger taxpayers''. Cf. Richardson (2006), p. 152.

is much higher for self-employed income than for wage income. This is often reasoned by lower tax morale of the self-employed, e.g. Kirchler (1998, 121) states: "According to prospect theory, it can be expected that self-employed people are more likely to take the risk of tax evasion and develop stronger antitax sentiments than employees". As our results indicate no differences in tax and fairness perceptions between employees and self-employed, different compliance rates seem to be mainly caused by different opportunities to avoid taxes (Kleven et al. 2011).

Finally, we are able to show that subjects, generally, prefer a progressive tax tariff not because of self-serving purposes but rather because of fairness reasons.

Appendix

See Tables 10 and 11.

Table 10 Results of the multinomial regressions: ATR misperception

Income	EUR 10,000	EUR 40,000	
	ATR overestimation	ATR underestimation	ATR overestimation
Constant	0.083	0.027	−0.357
University-entrance diploma	−0.212	−0.823***	−0.257
Age	−0.009	−0.007	−0.011
Self-employed	−0.219	0.443**	−0.055
Male	0.186	0.176	0.440***
Incl. soc. sec. contr.	0.795***	−0.881***	0.695***
Income (in EUR 10,000)	0.001	0.005	−0.043
Income close to EUR 10,000	0.366**	–	–
Income close to EUR 40,000	–	0.201	0.052
Nagelkerke-R^2	0.062	0.107	

Income	EUR 300,000		EUR 2,000,000	
	ATR underestimation	ATR overestimation	ATR underestimation	ATR overestimation
Constant	1.004***	−0.925***	0.347	−1.034***
University-entrance diploma	−0.931***	−0.019	−1.221***	−0.728***
Age	−0.013*	0.006	−0.006	0.009
Self-employed	0.201	−0.259	0.004	−0.093
Male	−0.092	−0.059	−0.109	−0.301
Incl. soc. sec. contr.	−0.648***	0.501***	−0.648***	0.107
Income (in EUR 10,000)	0.001	−0.043	0.006	−0.077
Income close to EUR 10,000	–	–	–	–
Income close to EUR 40,000	–	–	–	–
Nagelkerke-R^2	0.088		0.099	

Table 11 Results of the multinomial regressions: relative perceived tax burden

Income	EUR 10,000		EUR 40,000	
Burden	Too low	Too high	Too low	Too high
Constant	−2.177***	2.619***	−0.107	2.286***
University-entrance diploma	−0.455	−1.045***	−0.797**	−0.431**
Age	0.021	−0.020**	−0.014	−0.017**
Self-employed	−0.946*	−0.345	−0.006	0.037
Married	−0.904**	0.022	−0.063	0.391*
Male	2.177	−0.236	0.034	−0.023
Income (in EUR 10,000)	0.096	0.007	−0.065	−0.002
Income close to EUR 10,000	−0.498	−0.063	−0.221	0.108
Income close to EUR 40,000	–		0.284	−0.015
Nagelkerke-R^2	0.098		0.024	
Income	EUR 300,000		EUR 2,000,000	
Burden	Too low	Too high	Too low	Too high
Constant	0.826**	1.377***	1.294***	1.311***
University-entrance diploma	−0.598***	−0.191	−0.484**	−0.144
Age	−0.010	−0.019**	0.000	−0.022**
Self-employed	−0.039	0.252	−0.250	0.184
Married	−0.037	0.117	0.003	0.022
Male	0.183	−0.001	−0.252	−0.216
Income (in EUR 10,000)	0.010	0.055	0.016	0.089*
Income close to EUR 10,000	−0.289	0.210	−0.132	0.433
Income close to EUR 40,000	–	–	–	–
Nagelkerke-R^2	0.032		0.049	

* Significant at the 1 % level of confidence

** Significant at the 5 % level of confidence

*** Significant at the 1 % level of confidence

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