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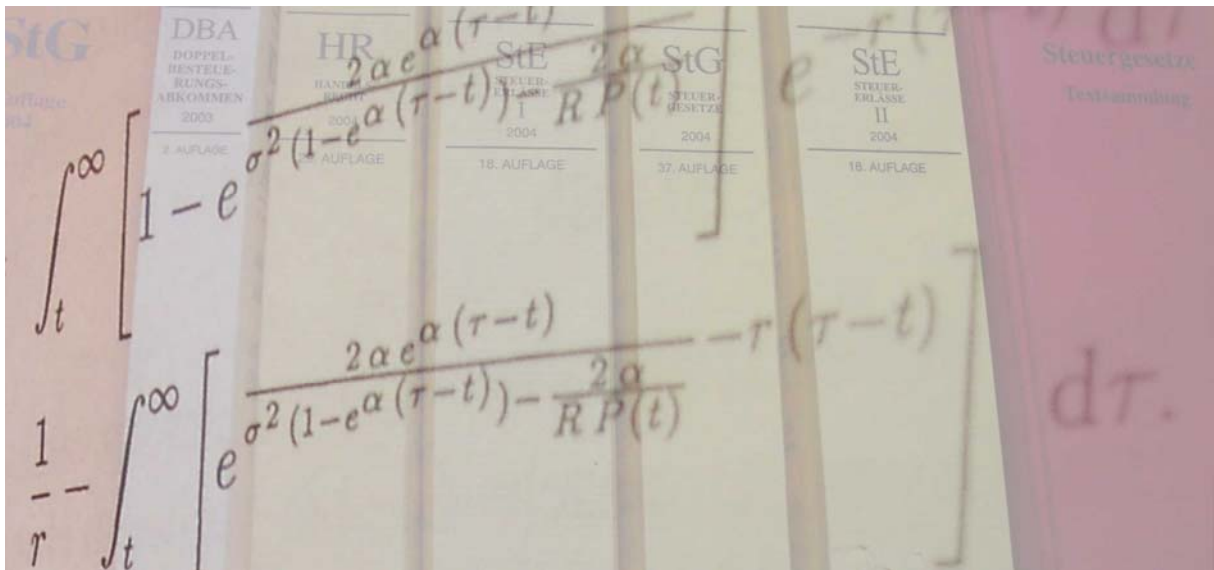
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Diskussionsbeitrag Nr. 99

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Tax Perception – an empirical survey

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Tax Perception - an empirical survey

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Abstract

This paper gives a survey of the experimental literature on the perception (bias) of individuals with respect to their own tax burden and its effect on economic decisions. Six strands of literature are discussed: (1) perception of marginal tax rates, (2) influence of tax complexity on tax perception, (3) taxation and incentives to work, (4) tax salience, (5) tax morale and fairness and (6) money illusion, perceived inflation and fiscal drag. The literature discussed contains more evidence for than against a perception bias.

JEL classification: H24, H31, D03

Keywords: taxation, tax perception, literature survey

1 Introduction

Economic literature traditionally starts from the assumption that tax payers perceive their effective tax burden correctly. Obviously, if this assumption is not correct, a number of standard results would have to be questioned. A number of publications have taught us that tax burden an individual perceives may differ from his or her effective tax burden. The purpose of this paper is to give a survey of the experimental literature on this topic. By the term “perceived tax burden” we understand the tax burden which a person explicitly estimates when he or she is asked to as well as an estimate which a person implicitly makes when taking an economic decision, e.g. on labor supply or asset allocation, or when voting in elections.

The paper is organized as follows: sections 2 to 7 each cover one specific aspect of tax perception, section 8 summarizes the main findings and concludes. Section 2 reports on papers which examine whether tax payers correctly estimate their marginal tax rate; in section 3 the influence of tax complexity on this estimate is treated. Section 4 embraces studies analyzing the relation of tax perception and labor supply. Empirical tests of the hypothesis of liability side equivalence are presented in section 5. Sections 6 and 7 cover related fields of research. Section 6 gives an overview of literature on tax morale and fairness. Section 7 covers the similar fields of money illusion, perceived inflation and fiscal drag. Our main focus is on experiments, but we also mention archival studies where necessary (sections 2 and 7). The issue of tax evasion (section 6) is covered in Torgler (2002). Therefore, we extend this author’s survey to publications beyond 2002.

Sections 2 to 7 all follow the same structure: we first summarize the main findings in the respective strand of literature. The most important papers and their results are presented in a table. Some selected papers are described and discussed in the text.

2 Perception of marginal tax rates

There are a number of studies, archival and surveys, which analyze the perception of individual marginal tax rates in a progressive income tax. The findings are not consistent but a majority of authors reveal misperceptions. It is not yet examined adequately which factors influence this misperception. König *et al.* (1995) find school education as the main determinant. Hundsdorfer and Sichtmann (2007) show that even physicians have difficulties to state the correct marginal tax rate. This suggests not only the level but also the kind of education, especially the existence of economical knowledge, is important. To our knowledge, there are no studies supporting this assumption. Nevertheless, it seems that more tax experience improves individual's perception. For example, Lewis (1978) shows that older individuals and Rupert and Fischer (1995) state that individuals with higher income are more accurate in their estimates. Gensemer *et al.* (1965) and Rupert and Fischer (1995) claim that a higher financial knowledge has a positive influence on tax rate perception.

Already in the sixties, Enrick revealed that the tax burden is not perceived correctly. In two surveys in the US he asked for the individual tax burden and found that the interviewees systematically undervalue their real tax burden (Enrick, 1963 / 1964). Subsequently, other researchers analyze survey data to obtain more knowledge regarding the perception of marginal tax rates. Table 1 summarizes the findings of these surveys. In all quoted papers, interviewees are asked a question similar to the following: "If you earn an additional amount of money, how much do you think you would have to pay in income taxes on that additional income?"

author	country	result
Gensemer <i>et al.</i> (1965)	USA	under- and overvaluation of marginal tax rate
Morgan <i>et al.</i> (1977)		
Lewis (1978)	UK	undervaluation of marginal tax rate
Fujii and Hawley (1988)	USA	
Rupert and Fischer (1995)	USA	overvaluation of marginal tax rate
Hundsdorfer and Sichtmann (2007)	Germany	

Table 1: Perception of individual marginal tax rate (survey data)

All of these studies reveal that taxpayers' perception of marginal tax rates is not correct but the direction of the misperception observed is not the same in all papers. One reason could be that the misperception differs between countries (e.g. due to different tax complexities). However, there are also inconsistent findings for the USA alone. To measure a misperception, the interviewees' estimates and his or her actual marginal tax rate have to be compared. For a correct determination of the true marginal tax rate, individual's taxable income has to be known exactly. Since researchers have no access to personal income tax data, they could only estimate or generalize this amount. For example Fujii and Hawley (1988) and Rupert and Fischer (1995) assume that each household took standard deductions. As individuals may have declared higher actual deductions instead, this assumption obviously leads to a bias and distorts the comparison of estimated and true marginal tax rate. Another potential reason for inconsistency could be the additional amount of income which is assumed in the surveys. Gensemer *et al.* (1965), Lewis (1978) and Fujii and Hawley (1988) ask interviewees to assume one currency unit of additional income, in Morgan *et al.* (1977) the hypothetical amount is 100 US-Dollars, in Rupert and Fischer (1995) 1000 US-Dollars, and in Hundsdoerfer and Sichtmann (2007) 100 Euros. In our view, this should have no big influence on perception but it cannot be ruled out that this different framing induces different levels of misperception.

Beside these surveys there are some econometric studies which analyze individuals' perception of marginal tax rates. Most of these studies are based on a model first developed by Rosen (1976a / 1976b) and use multivariate methods (e.g. OLS-, NLLS or ML-estimation). In these analyses, the dependent variable is the number of work hours over a specific time period of an individual. The research question is: Do individuals base their work hours' decisions on a correctly perceived marginal tax rate? Therefore, independent variables, which possibly have influence on the dependent variable, are the individual marginal tax rate, the gross wage and some other personal characteristics such as number of children and degree of education. The resulting estimators for the coefficients of these independent variables are used to compute a parameter of misperception. Table 2 gives an overview of these studies and their findings.

author	country	result
Rosen (1976b) Rosen (1976a)	USA (only women)	correct valuation of marginal tax rate Individuals react on tax rate modification rationally, i.e., labor supply decisions based on net wages.
Brännäs and Karlsson (1996)	Sweden (only men)	
König <i>et al.</i> (1995)	Germany (only women)	undervaluation of marginal tax rate Labor supply decisions not based on an accurate knowledge of individuals' marginal tax rate.
Arrazola <i>et al.</i> (2000)	Spain (only men)	overvaluation of marginal tax rate Labor supply decisions not based on an accurate knowledge of individuals' marginal tax rate.

Table 2: Perception of individual marginal tax rate (econometric studies)

Peek and Wilcox (1984) use a similar technique to examine the influence of tax rate changes on rates of return. The main finding is that after a tax rate change, pretax rates of return vary in such a way that the same net rates are achieved as before. This gives evidence that tax rates are perceived correctly in investment allocation.

In our opinion, there are a number of reasons which possibly explain the inconsistent results between the econometric studies. (1) The more complex or non-transparent a tax regime the more pronounced might be the misperception. Thus, one reason for the disparity between these studies could be a difference in tax complexity or transparency of tax law among the countries analyzed. (2) Tax reforms may have led to an increase of tax complexity. Therefore, misperception may rise over time. (3) The econometric model which is used to compute the parameter of misperception is varied between the studies. For example, different individual characteristics are used as independent variables and different statistical methods are applied. (4) Besides, there may be a gender effect or (5) sample size may be too small in some cases. For example Brännäs and Karlsson (1996) include only 726 observations in their estimation. These potential reasons for inconsistency should be considered in further research. Moreover, a comparative study is desirable which analyzes all econometric studies with respect to these problems.

In addition to this strand of literature, in a few studies the perception of special tax provisions and the influence of the tax framing on perception are analyzed. In Fochmann *et al.* (2010a) the perception of income taxation with different loss deduction rules and their influence on investment behavior is analyzed experimentally. Subjects' task is to choose between two investment alternatives that have the same expected value, but differ in variance. In the baseline treatment no tax is levied on gains and no loss deduction appears in case of a loss. Contrary to this, in the perception treatments gains are subject to a proportional income tax with a rate of 35 % but loss offset rules differ between these treatments. Independent of the special tax provisions, after-tax payoffs of the investment alternatives in all perception treatments are equal to the payoffs in the baseline treatment. Hence, it is to be expected that subjects take the same decisions in all treatments. The authors find that the number of risk seeking investors is not significantly greater than the number of risk averse investors when there is no taxation. The same is true in the case of proportional income taxation without loss deduction. However, when there is a partial or capped loss deduction rule, a strong and significant bias towards risk seeking behavior is observed. It seems that the value of loss deduction is overestimated. Since losses are optimistically assumed to weigh less in these situations, the decision makers feel safe to take on greater risks.

In the study of Lozza *et al.* (2010) subjects are confronted with a fiscal bonus due to a hypothetical change in tax policy. In two treatments the presentation of this bonus is varied to analyze the influence of framing effects on tax perception. The following presentation is applied: "Suppose that a recent tax reform led to some changes in national tax policy. These changes include a fiscal bonus, which allows you to enjoy a *60 € increase in your monthly income [a reduction in your tax burden of 60 € per month]*." Participants' task is to evaluate the bonus and to state how they will use this money (spending or saving). As a result, subjects assess the value of a fiscal bonus higher when it is framed as the avoidance of a loss, rather than as a gain. Additionally, respondents are more willing to spend instead of save the money when it is framed as a gain. The latter finding is also observed in Epley *et al.* (2006).

3 Tax complexity

The complexity of a decision problem can be characterized by the variety of influencing factors and by the extent of their dependences. As mentioned in section 2, tax complexity may be responsible for the misperception of tax rates. Congdon *et al.* (2009) claim that “individuals will respond not to the tax rate as it is set but as they construe it” (p. 378). Conceivably, the more complex a tax system is the larger may be this difference between the legal tax and the construed tax. As a result, this bias can affect real decision problems. Chetty and Saez (2009) find in a field experiment that extra information about the Earned Income Tax Credit (EITC) affects labor supply and earnings decisions of the recipients. It seems that the EITC system is too complicated to be perceived correctly. However, additional information reduces complexity and recipients adjust their behavior.

A number of experimental analyses also show that the correct perception of tax effects in individuals’ decision making is influenced by the complexity of the tax system. However, these papers don’t investigate complexity in the sense defined above, but rather vary the complexity and transparency of the presentation of tax scales. In these experiments, the outcome from a certain action is subject to tax. Between the treatments, the complexity or presentation of tax base and tax scale is varied. The main finding of these papers is that the higher tax complexity is the worse is the subjects’ judgment and quality of decisions. Furthermore, it can be observed that even market efficiency is influenced by tax complexity. Compared to a control treatment, subjects need more rounds until the market equilibrium is reached. Table 3 gives an overview of studies on this topic.

author	How different levels of complexity are modeled
Bartolome (1995)	form of tax scale presentation
Rupert and Wright (1998)	
Rupert <i>et al.</i> (2003)	number of elements determining marginal tax rate
Boylan and Frischmann (2006)	
Blaufus and Ortlieb (2009)	wording of legal text and number of calculating operations

Table 3: Influence of tax complexity on individuals’ decisions

Boylan and Frischmann (2006) show the impact of complexity by means of a laboratory experiment. The experiment consists of two treatments which differ only in tax complexity. In each treatment, subjects attain gains by trading goods. In the low complexity treatment, these gains are subject to a linear tax at a rate of 40 % independent of the respective gain level. In the high complexity treatment, the tax payment is determined by different elements: (1) gains are subject to a tax at a rate of 15 % independent of the gain level plus (2) a negative or positive tax payment which depends on the pretax gain. The respective amounts are displayed in tables to the participants and are chosen in such a way that effective tax rate in the high complex treatment is also 40 % independent of the pretax gain level. Thus, both treatments are identical with regard to the tax burden but in the high complexity treatment the total tax payment has to be derived from instructions. The results of this experiment confirm the authors' hypothesis that tax complexity has a negative impact on investor profits. In the high complexity treatment, prices and quantities are above the market equilibrium thus causing market inefficiencies. However, it can be observed that differences between both treatments diminish over the course of the experiment. Possibly, this can be attributed to learning effects in the high complexity treatment. However, the analysis of a control question regarding the effective tax rate which was asked at the end of the experiment reveals that no subject realized the correct tax rate. Only three out of twelve answers were in the right interval between 30 % and 45 %.

In an experiment by Bartolome (1995), complexity is generated by a variation in the presentation of the tax scale. The first form of presentation is a tax table in which the absolute tax burden is specified for a given taxable income but no explicit tax rate is given. In the second form the tax scale is described verbally and the marginal tax rates are stressed out explicitly. Thus, both descriptions represent the same progressive tax scale but the marginal tax rate cannot be identified immediately with the first form. The results of this experiment reveal that subjects consider taxation in their investment decisions independent of the tax scale presentation. However, the majority of participants use the average and not the marginal tax rate for their decisions in the treatment with the tax table. Most subjects use the average tax rate as if it is the marginal tax rate. Therefore, they consider the tax burden in principle but undervalue the real tax effect. Contrary to these results, subjects in the second treatment use the marginal tax rate in most cases. The author concludes that the correct use of marginal tax rates can be obtained by a transparent specification of marginal tax rates whereas tax tables tend to mislead taxpayers. Along the same lines, Rupert and Wright (1998) use four different

presentation forms of a tax scale which differ in the visibility of marginal tax rates. These authors also show that a higher visibility of marginal tax rates leads to better investment decisions.

With an experiment, Rupert *et al.* (2003) analyze to what extent a more complex tax system influences the perception of marginal tax rates and the decision making process of an individual. Complexity is measured by the limitation of possible tax deductions in a tax system. Therefore, the more limitations exist the more complex is the tax system. The limitations are chosen in such a way that the effective marginal tax rate is the same for all treatments independent of the complexity of the respective tax regime. The authors show that subjects in the more complex tax systems are not able to estimate their effective marginal tax rates accurately. The results suggest that subjects do not adjust their estimates to account for the effects of limitations and, therefore, undervalue their true marginal tax rate. An increase of complexity leads to more misperceptions. As a result of this misperception, participants in the more complex treatments choose the optimal investment less frequently. Thus, low complexity leads to a better performance and to more efficiency.

Blaufus and Ortlieb (2009) examine complexity's influence on individual decisions with a conjoint analysis. In this study, higher tax complexity is achieved with an increase of tax compliance costs measured by the time participants needed to understand the respective tax regime. Therefore, the length of the tax instructions and the number of technical terms, calculating operations and cross references are varied. The authors show that subjects base their decisions less often on their after-tax return if tax complexity is high. However, even in a low complexity tax system subjects often do not calculate their after-tax return but base their decisions on the advice offered by a third party in the interview.

4 Taxation and incentives to work

Several experimental studies examine the impact of the tax rate level, the tax scale, and the kind of taxation (levied on income or on consumption) on labor supply. It can be summarized that a negative relation between the incentive to work and the marginal tax burden is observed (Swenson, 1988; Sillamaa, 1999c and Sutter and Weck-Hannemann, 2003). Furthermore, an increase in gross wage induces a higher labor supply in an indirectly progressive tax scale with a constant marginal tax rate compared to an equivalent directly progressive tax scale (Sillamaa, 1999a). Another experiment reveals that labor supply is less affected when the tax is levied on consumption than when it is levied on income (Blumkin *et al.*, 2008). Using a

linear tax on wages, the Laffer curve is verified and the highest tax revenue is achieved with tax rates of 50 % and 73 %, respectively (Sutter and Weck-Hannemann, 2003 and Swenson, 1988). Table 4 gives an overview of the main findings of these experimental studies.

author	result
Swenson (1988) Sillamaa (1999c) Sutter and Weck-Hannemann (2003)	negative relation between labor supply and marginal tax rate
Sillamaa (1999a)	increasing gross wage induces higher labor supply in an indirect progressive tax scale with an exemption and constant marginal tax rate compared to an equivalent direct progressive tax scale
Sillamaa (1999b)	tax scale with a marginal tax rate of zero for top income induces higher labor supply as a tax scale with a marginal tax rate greater than zero
Blumkin <i>et al.</i> (2008)	tax on consumption leads to higher labor supply than an equivalent tax on labor income
Fochmann <i>et al.</i> (2010b)	subjects tend to base their labor decisions on a mix of gross and net wage

Table 4: Influence of taxation on labor supply (experimental studies)

Sillamaa conducts several experiments to analyze the impact of different tax regimes on labor supply. In Sillamaa (1999b), participants are divided into two groups at the beginning of the experiment. In one group, subjects' decision task is to decode numbers into letters with the use of a paper decoding sheet. The subjects in the other group have to type a single character in an input mask. The income from each work is taxed but the tax scale differs from period to period. Therefore, participants are faced with several tax regimes in every work period. The author focuses on two special tax regimes: (1) a "regressive tax" and (2) a tax scale with a marginal tax rate of zero at the top income ("zero-tailed regressive tax"). Both tax regimes are characterized by decreasing marginal tax rates. But contrary to the "regressive tax", no further tax is levied in the second system if a certain work output is exceeded by a participant. Until this limit, taxation is absolutely identical in both tax regimes. The limit is set to 105 % of an individual's work output (number of correctly decoded or typed characters) in the period with the regressive tax. Thus, the zero-tailed regressive tax regime is always implemented after the regressive tax regime. However, subjects are unaware of this 105 %-threshold. Theoretically,

the zero-tailed regressive tax regime should lead to a higher labor supply. Indeed, both working groups exhibit a significant higher work output than in the regressive tax regime. Thus, the existence of this theoretical incentive is confirmed experimentally.

In a further experiment, Sillamaa (1999a) examines the impact of an increasing gross wage on labor supply. Again, participants' decision task is to decode numbers into letters and the income from work is taxed. The author distinguishes two progressive tax scales: (1) a directly progressive tax scale and (2) an indirectly progressive tax scale with an exemption and a constant tax rate. The second tax scale is chosen in such a way that both taxes are equivalent with regard to the level of work effort and after-tax consumption before gross wage increase. In the following, it is hypothesized and confirmed that an increase in the gross wage induces a higher labor supply with the linear tax than with the directly progressive tax.

It can be noted critically that in both experiments of Sillamaa a neutral framing is applied, i.e., the author consciously avoids any reference to taxation. Participants are only informed about net wages, they are not aware of the interaction of gross wage and tax payments leading to this payoff. Further research is necessary to find out whether an explicit tax framing leads to different results. There are, for example, experiments where tax morale in an explicit tax framing is higher than predicted (section 6).

In Swenson (1988) and Sillamaa (1999c) the influence of different tax rate levels on labor supply decisions is analyzed. In both labor experiments the tax rates 12 %, 28 %, 50 %, 73 %, and 87 % are applied and each participant is confronted with all of them (within-subject design). Contrary to Swenson, Sillamaa does not display tax rates but only net wage rates (neutral framing). In both experiments, the total tax revenue of one period is redistributed to the subjects. The redistribution mechanism differs. In Swenson (1988), redistribution is determined by the tax payments of several participants. From this total amount, each subject receives a share at random in the next period. In the study of Sillamaa, each participant receives a certain share which only depends on his own tax payment. The amount is determined by the personal tax payment of the previous period plus/minus a random amount of at most 5 % of this tax payment. Randomization is used to veil the functional relation between tax payment and redistribution. By the use of a complete redistribution of tax revenues, both authors claim to eliminate an income effect completely. Thus, a participant's change of behavior can be attributed to the substitution effect between work and leisure. In this setting, an increasing tax rate does not lead to a decrease in income when participants

supply the same amount of labor. Nevertheless, due to a substitution effect, labor supply is expected to decrease under a balanced-budget increase in the tax rate (Lindbeck 1982). Indeed, both experiments confirm this theorem. However, in the experiment of Swenson, this is not true for the lowest tax rate since labor supply decreases compared to the labor supply in the case of higher tax rates (kinked labor supply curve). This may be a random result or the effect of the redistribution mechanism installed which does not eliminate the income effect perfectly.

From the viewpoint of a rational decision maker, a tax on labor income and a tax on consumption are complete substitutes if earned income must be spent immediately on consumption or if no interest-bearing investment is available. Thus, labor supply should be the same under both forms of taxation. Blumkin *et al.* (2008) examine this theoretical equivalence in a laboratory experiment and focus on the incentive to work under each tax regime. The experiment consists of three different phases. The first phase is used to measure the work ability (productivity) of each participant. For this purpose, subjects have to solve by hand as many as possible two-digit by two-digit multiplication questions in three minutes. For every correct answer, participants get money. The second phase is applied to determine the work-leisure preference of a test person. Like in the first phase, participants are asked to solve multiplication questions. For each correct solution, a subject now receives two points which can be converted into two consumption goods: falafel or pizza vouchers. Contrary to the first phase, a participant is able to stop working within the time period and do nothing (“leisure”). In this case, a participant gets a soft drink voucher for every 15 seconds of leisure time. Through this mechanism, subjects gain utility from leisure. Henceforth, test persons do not earn points for falafel or pizza vouchers during leisure time. The third phase is identical to the second, but a tax either on labor income or on consumption is levied (between-subject design). In the labor income tax treatment a 50 % wage tax is imposed on the earnings. Thus, a subject receives only one point for each correct answer instead of two. In the consumption tax treatment a 100 % tax on consumption is imposed on every consumption good. Thus, the price of each consumption good has doubled compared to phase two, whereas the value of a correctly answered question is still two points. The leisure good (soft drink) remains untaxed in either tax treatment. Therefore, equal labor supply leads to identical consumption abilities and tax burdens in both treatments and labor supply should be the same. A comparison of phase two and three reveals that the substitution effect is greater than the income effect in this experiment. This means that taxation leads to a decreasing labor supply and, therefore, to a

higher preference for leisure. This significant result holds for both tax treatments. However, the decrease is much more pronounced in the labor income tax treatment than in the consumption tax treatment (comparison within the third phase). Thus, it can be concluded that the incentive to work is higher in case of a consumption tax. The theoretical equivalence of both tax regimes cannot be verified in this experiment. According to the authors, a potential reason for this phenomenon may be that subjects underestimate the cost of consumption in the future. The authors develop a model based on the results of this experiment to show that a shift from an income tax to a consumption tax reduces the excess burden from taxation.

Fochmann *et al.* (2010b) ask a much simpler question: Does the gross wage influence the individual labor decision? In this study, only employed persons (no students) are used as subjects and a real effort experiment is conducted in which participants have to fold letters. Subjects have to make a real work-leisure decision because they decide not only about their work effort but also about the total time they spend on working. There is no time restriction. In the reference treatment, no tax is levied. In contrast, income from work is subject to a tax with a constant marginal rate of 25% or 50% in the tax treatments. Tax revenues are not redistributed to the participants. An income effect from taxation is avoided in this experiment since in all treatments the net wage rate is identical. Therefore, the same labor supply is to be expected. Nevertheless, subjects work harder and longer when they are taxed. It seems that participants mix up the gross and net wage when they decide about their labor supply. The authors denote this effect ‘gross-wage illusion’.

5 Tax salience

The theoretical literature is mainly based on the assumption that tax incidence is independent of the market side (supply or demand) on which a tax is levied. This theorem is known as “Liability Side Equivalence Principle” (LSE). However, already in the nineteenth century John Stuart Mill dealt with tax perception and claimed the following hypothesis which is named after him:

“Perhaps [...] the money which [the taxpayer] is required to pay directly out of his pocket is the only taxation which he is quite sure that he pays at all. [...] If all taxes were direct, taxation would be much more perceived than at present; and there would be a security which now there is not, for economy in the public expenditure.” (Mill 1848)

In line with this hypothesis, Chetty *et al.* (2009) observe in a field experiment that consumers do not react correctly to taxes that are not salient. In this study, it is shown that taxes which are not explicitly posted on the price tags are totally ignored when calculating the total price of the purchased goods. If both the pretax price and the tax-inclusive price are posted, consumers perceive the total tax-inclusive price correctly. In a number of laboratory experiments, tax salience and its influence on economic decisions is examined. In all of these studies, non-salient taxes are reflected by taxes which are levied on the other market side. Conclusions from these results are mixed. In most experiments, it appears that subjects realize the incidence of an indirect – non-salient – tax (exception: Kerschbamer and Kirchsteiger, 2000). Nevertheless, in some studies correct perception by the participants occurs not immediately. Depending on the experimental design, subjects need some rounds until learning effects lead to an efficient pricing. Table 5 overviews these experimental studies and their results.

author	result
Kachelmeier <i>et al.</i> (1994)	confirming LSE
Borck <i>et al.</i> (2002)	
Riedl and Tyran (2005)	
Menges and Traub (2008)	
Ruffle (2005)	
Sausgruber and Tyran (2005)	mixed results (learning effects lead to a more correct perception)
Sausgruber and Tyran (2008)	
Kerschbamer and Kirchsteiger (2000)	rejecting LSE

Table 5: Experimental studies testing the Liability Side Equivalence Principle (LSE)

A laboratory experiment of Sausgruber and Tyran (2005) shows very clearly that learning effects are necessary for a correct tax perception. In this experiment, participants have to trade goods on a market but take only the role of the demand side. The supply side (sellers) is automated which is known to the subjects. The experiment consists of four phases and each phase consists of 15 trading periods. After the first phase without taxation, subjects have to vote on a proposal to tax market transactions and to redistribute the tax revenues to market

participants (public good). If participants reject this proposal, no tax is levied and also no public good is provided like in the first phase. Depending on the treatment, participants have the option either to implement a direct (treatment TT: buyer is taxed) or an indirect tax system (treatment IT: seller is taxed). Note that participants cannot choose between both tax systems but only vote whether to implement the respective tax regime (direct or indirect) or not. The authors have designed both different tax settings in such a way that the direct tax cannot be shifted to sellers and that the indirect tax is shifted completely to buyers. This mechanism is unknown to the participants. As a result, buyers bear the full tax burden and, therefore, both treatments are completely identical in an economic sense. Since buyers and sellers participate in equal shares from the provided public good, the acceptance of the proposal in all cases leads to a decreasing net income for the participants. Therefore, voting for the introduction of a tax is irrational since the buyers' share of the tax revenue is always lower than the tax they have to bear.

In the experiment, participants have to decide on the introduction of a tax three times whereas the treatments differ by the sequence of tax regimes proposed. The following sequences exist: (A) TT-TT-IT and (B) IT-IT-TT. A comparison between the first referenda of both groups allows the analysis of fiscal illusion. In addition, a comparison between the first and the second or the third referendum within a group uncovers learning effects. In the first referendum of group A (on first TT), subjects reject the introduction of the direct tax regime in nine out of ten cases. By contrast, subjects in group B (on first IT) vote for the introduction of the indirect tax regime in nine out of ten cases. From a questionnaire, the authors find out that 23 % (55 %) of participants expect an advantage from a direct (indirect) tax implementation. Furthermore, 30 % of subjects expect no tax shifting in the indirect treatment. As a result, it can be stated that tax perception is much more pronounced in the direct tax regime and, therefore, fiscal illusion really exists. From the second referendum, the authors observe a learning effect since the number of electors who vote for the proposal decreased heavily and participants' expectation improved in general. However, some misperception still remains but its extent declines compared to the beginning. From our point of view, this indicates very well that individuals do have the ability to assess their tax burden rationally if they have the possibility to learn. It can be assumed that the implementation of further phases would reveal that no meaningful differences between both treatments remain. Additionally, markets equilibrate quickly and reliably independent of the tax regime. As a

result, the LSE cannot be rejected. The same authors verify these results in a further, similar experiment (Sausgruber and Tyran, 2008).

Kerschbamer and Kirchsteiger (2000) examine the LSE by means of the ultimatum game where either the proposer or the responder has to pay a tax. Contrary to both experiments of Sausgruber and Tyran, the authors reveal no learning effect. Therefore, LSE has to be rejected. We believe that the special design of the ultimatum game causes this result (compare also Ruffle, 2005, p. 1522).

In Ruffle (2005), participants are confronted with a tax implementation either on buyers' or on sellers' side after some tax free periods. In two further treatments, the buyer or the seller side obtains a subsidy which can be considered as a negative tax. Theoretically, tax burden and subsidy relief depend only on the elasticity of demand and supply. The LSE should hold for the tax as well as for the subsidy treatments. In this experiment, participants trade goods on a pit market. Thus, unlike other studies, price negotiation is not conducted anonymously. Rather, a participant may select his trading partner by himself. In total, 552 subjects participated in this experiment. Like in the tax free periods, the theoretical price equilibrium is reached after the tax or the subsidy implementation. Moreover, the variance of the price diminishes over several periods. This indicates that all subjects match with the equilibrium (learning effect) and can be seen as a confirmation of the LSE. However, the variance of the price in the subsidy treatment is higher compared to the tax treatment. Possibly, this is caused by a lack of experience with subsidies compared to taxes. With regard to the number of participants within each group, the experiment reveals that in smaller groups equilibrium is reached more slowly.

Further studies which verify the Liability Side Equivalence Principle experimentally are Borck *et al.* (2002), Riedl and Tyran (2005), Menges and Traub (2008), and also Kachelmeier *et al.* (1994). In the latter a neutral framing is used, i.e., tax wording is completely avoided. Altogether, it can be claimed that individuals realize very well to what extent they are burdened with a tax – irrespective of whether they themselves or the other market side have to pay it.

6 Tax morale and fairness

In principle, tax evasion can be considered to be individually rational if the taxpayer is still able to make use of the public good since he benefits – as a free rider – from the tax payments of others. Allingham and Sandmo (1972) show theoretically that tax compliance increases if audit probability (detection probability of tax evasion) or the level of penalty rises. The influence of the tax rate on tax compliance is ambiguous. The authors show that the tax rate effect depends on taxpayer’s risk attitude. In the literature, tax morale generally indicates the truthful declaration of a taxable base and has been intensively analyzed in experiments (for a detailed survey see Torgler 2002). For the most part, the theoretical findings are confirmed, especially for the statements regarding audit probability and penalty. Table 6 overviews the studies and their results.

fiscal parameter	result	method	author
tax rate	negative relation between tax rate and tax morale	experiment	Friedland <i>et al.</i> (1978) Collins and Plumlee (1991)
	positive relation between tax rate and tax morale		Beck <i>et al.</i> (1991) Alm <i>et al.</i> (1995)
	mixed results		Fortin <i>et al.</i> (2007)
audit probability	positive relation between audit probability and tax morale	experiment	Spicer and Thomas (1982) Beck <i>et al.</i> (1991) Alm <i>et al.</i> (1995) Maciejovsky <i>et al.</i> (2001) Cummings <i>et al.</i> (2005) Fortin <i>et al.</i> (2007) Gërxhani and Schram (2006)
		data analysis	Witte and Woodbury (1985) Dubin and Wilde (1988) Slemrod <i>et al.</i> (2001) Torgler (2003)
penalty	positive relation between fine and tax morale	experiment	Alm <i>et al.</i> (1995) Maciejovsky <i>et al.</i> (2001) Feld and Tyran (2002) Cummings <i>et al.</i> (2005)

Table 6: Influence of fiscal parameters on tax morale

These experimental studies regularly reveal that participants' tax morale is higher than the tax morale of the *homo oeconomicus*. Many experiments are design in a way that rational behavior would require complete tax evasion. However, participants regularly do not behave in the way predicted. As a result, it is generally supposed that individuals have a kind of intrinsic motivation to pay taxes. Some studies examine the influence of the use of taxpayers' money (affectation) on the individuals' willingness to evade taxes. In a fundamental paper, Kolm (1973) establishes a tax evasion model where the utility of a tax financed public good is explicitly integrated in the decision about the extent of tax evasion. Vogel (1974) conducts a survey in Sweden and find that the willingness to evade taxes decreases if some benefit is provided in return for the tax payment. Lewis (1979) attains similar results for Great Britain.

Feld and Tyran (2002) conduct a laboratory experiment and implement three treatments where a tax is levied to finance a public good which offers some benefit for the participants. A subject's declared income serves as tax base. Contrary to other studies, the audit probability is set to 100 % and, therefore, tax evasion is always uncovered. In the first treatment, a detected tax evasion remains without consequences since there is no fine on tax evasion. Under the assumption of rational behavior, this design induces complete tax evasion (free riding). Indeed, participants declared 30 % of their income on average although there is no risk of having to pay tax arrears or of being penalized. It seems that an intrinsic motivation to pay taxes is responsible for this finding. In the second treatment, tax evasion is punished with an exogenous fine which is set to 20 % of the maximum declarable amount, but tax evaders are not required to pay tax arrears in this experiment. The penalty parameter is chosen in such a way that a complete tax evasion is still rational despite the penalty and the audit probability of 100 %. As a result, declared income rises slightly to 38 % on average. However, the difference between the results of the first and second treatment is statistically not significant. Therefore, the implementation of an exogenous fine (extrinsic motivation) induces no change in participants' tax morale. The authors' wording is somewhat misleading. In the real world this rather resembles a partial detection of under-declaration and a subsequent payment of the detected tax arrears which may or may not be accompanied by a penalty.

In the third treatment, the impact of participants' choice to implement a penalty or not on tax morale is examined. If the proposal is accepted, penalty is identical to the exogenous fine of the second treatment. However, each subject has to declare his income before knowing the voting result. The authors observe less tax evasion in this treatment with an endogenous fine compared to the treatment with the exogenous fine. They suppose that direct voter

participation is responsible for the lower extent of tax evasion since the legitimacy of policy outcomes increases. This means that having influence on the implementation of the tax or fine system raises participant's tax morale. This is in line with the finding that participants who vote for the proposal reveal higher tax morale compared to the exogenous treatment. A further explanation for increasing tax compliance might be reciprocity. It seems that the own decision for the proposal is understood as a signal to other subjects for a higher individual tax morale. This signal may induce other participants to be more compliant, too. Therefore, tax morale increases if further pro-voters appear. It can be stated that "the more subjects expect the others to comply with the tax law, the higher is their tax morale as well" (Feld and Tyran, 2002, p. 218).

The positive correlation between political participation and tax compliance which is proved by Feld and Tyran (2002) is verified experimentally by two further studies: Weck-Hannemann and Pommerehne (1989) show that taxpayers who have the ability to participate in the decision process about the use of tax payments perceive tax payments as more fair. The authors conduct an econometric analysis of a tax evasion model based on aggregate tax data for Swiss cantons. Furthermore, in the examination and in the literature survey of Pommerehne (1985) it is shown that tax evasion is less common in those Swiss communities and cantons where taxpayers have a right of political participation. According to Frey and Eichenberger (1996), taxpayers' participation in tax policy helps to increase tax satisfaction.

Spicer and Becker (1980) and also Fortin *et al.* (2007) find further interesting results regarding fairness effects. With respect to participants' income declaration, they observe that individual tax evasion increases if the own tax rate rises relative to the rate of the other participants. A reason for this might be that subjects attempt to attain (fiscal) equity through tax evasion. Cowell (1992) provides a theoretical model for this explanation.

Güth *et al.* (2005) examine how far tax morale depends on a central or decentralized tax collection. Therefore, two treatments are implemented: For one thing, a decentralized tax collection is applied, i.e., tax revenue of a region is used to provide a public good in the same region (local tax). For another thing, total tax revenues of two regions are levied centrally and are redistributed in equal shares to both regions afterwards in the other treatment. As a result, a decentralized tax collection causes a higher level of tax compliance.

In a study of Güth and Sausgruber (2008), election preferences for different tax regimes and also tax morale under these regimes are analyzed. Therefore, a tax regime with an income tax

and a tax regime with an income and a (distorting) commodity tax are compared. In both tax regimes, income taxes can be evaded without any punishment but the commodity tax cannot be evaded. Tax revenues from both taxes serve to provide a public good. In this experiment, a complete evasion of income tax is rational from an individual's perspective. However, every subject can improve his or her position if all subjects pay income taxes and, therefore, the public good is provided to the highest possible extent. It is expected that participants vote for the tax regime with income and commodity tax because this regime promises a higher payoff if subjects behave rationally and evade income taxation. Indeed, experimental results reveal the opposite. Participants prefer the tax regime with just income tax. In addition, subjects in this tax regime exhibit higher tax morale. This contradicts the results of a survey by Cullis and Lewis (1985) whereby interviewees favor a commodity tax over an income tax for an increase in tax collection.

Possibly, neuroeconomics offer additional insight into individuals' high tax compliance which cannot be explained in the model of the *homo oeconomicus*. For example, Harbaugh *et al.* (2007) show that both compulsory levies and voluntary donations to a charity cause similar patterns of brain activity that are observed when the test person receives a payment in his own favor. The authors interpret this as evidence for perfect altruism as well as for the motive of a "warm glow of giving", i.e., a subject's utility from his or her voluntary donation. A further strand of literature attempts to measure subjective effects of taxation and subjective assessment of its fairness.

7 Money illusion, perceived inflation and fiscal drag

Inflation together with a progressive tax scale defined in nominal terms (without adjustments for inflation) causes an increasing tax burden over time for an invariant real income. This phenomenon has been known as fiscal drag (sometimes also bracket creep). To our knowledge, there are no empirical examinations of the perception of fiscal drag. However, we believe that the results of studies on money illusion indicate that the increase of the effective tax burden on an invariant real income caused by inflation is not perceived to its full extent. The underestimation of the effect of fiscal drag finally induces a lower "perceived" tax burden. This should be valid at least in the low-inflation environment we have been experiencing over the last two decades. By contrast, we expect a stronger perception of fiscal drag if inflation rates and nominal income should rise in the future. Experimental studies are an appropriate means to find out more about this issue.

Money illusion refers to the idea that individuals base economic decisions rather on nominal than on real terms. In the literature the existence of money illusion is controversial, as the following quotations represent:

"An economic theorist can, of course, commit no greater crime than to assume money illusion" (Tobin, 1972, p. 3)

"In fact, I am persuadable - indeed, pretty much persuaded - that money illusion is a fact of life" (Blinder, 2000, p. 54)

There are both field data and experimental analyses which reveal that people base their economic decisions primarily on nominal terms. Nevertheless, if they are confronted with real terms, their behavior changes. It is observed that extreme alterations in the financial environment – e.g. an abruptly increasing inflation rate or a monetary reform – lead to difficulties in individuals' decision making and adverse effects on markets' efficiency. However, learning effects are proven which cause a diminishing of decision errors over time. Table 7 gives an overview of relevant studies. We conclude from these findings that especially an extensive or extreme revision of tax law should induce adjustment problems at first, but these problems should vanish after several months or after few years.

An aspect of money illusion is individuals' perception of the rate of inflation. The tenor of these studies is that a difference between real and perceived inflation rates does exist (compare Bechtold and Linz, 2005; Dziuda and Mastrobuoni, 2005; Antonides, 2008; Brachinger, 2008; Gärling and Gamble, 2008; for a detailed survey see Ranyard, *et al.* 2008). Bechtold and Linz (2005) partly explain this difference by an overvaluation of single (high) price increases (e.g. in restaurants). Due to the fact that the respective commodities represent only a small proportion of the basket which finally defines the inflation rate, price increases of these goods do not influence the real inflation rate significantly. Nevertheless, such an overvaluation could cause an excessive "perceived" inflation rate. Dziuda and Mastrobuoni (2005) argue in the same line and claim that especially prices of such goods are overvalued which are rather cheap or which are purchased frequently. A further argument for the misperception of the inflation rate may be that price decreases are undervalued or that indirect price decreases through technological advances influence perception only slightly.

author	method	result
Modigliani and Cohn (1979) Cohen <i>et al.</i> (2005)	data analysis (USA)	On the capital market there is a systematical mispricing since real terms are discounted by nominal terms.
Kooreman <i>et al.</i> (2004)	data analysis (Netherlands)	A comparison of donations for charity organizations before and after the introduction of the Euro. Donations disproportionately increased.
Cannon and Cipriani (2006)	data analysis (several European countries)	Analogous study to Kooreman <i>et al.</i> (2004) with similar results. The extent of money illusion differs between countries, especially in countries with “soft” currency (e.g. Italy) money illusion is more pronounced.
Shafir <i>et al.</i> (1997)	survey (USA)	Individuals mix up nominal and real terms in their decisions which causes misperceptions. The presentation of the problem set influences individuals in the use of nominal or real terms.
Fehr and Tyran (2001)	experiment (Switzerland)	Authors examine whether a change in money supply influences pricing. Contrary to a presentation in real terms, equilibrium is only reached after a couple of periods if the decision problem set is presented in nominal terms.
Fehr and Tyran (2007)	experiment (Switzerland)	Nominal (real) presentation of decision variables causes a pareto-inferior (pareto-optimal) equilibrium. However, if subjects are confronted with rationally operating market players, learning effects are observed.

Table 7: Studies and their results regarding money illusion

8 Conclusion

Most of the papers discussed in this survey give empirical evidence for a biased perception of taxpayers' own tax burden and distorting effects on economic decisions. On the other hand, there is also some evidence for a correct perception. There is a need for further experimental research in all six strands of literature discussed.

With all due caution we draw the following generalized conclusions from the literature: Test persons and interviewees in several countries rarely give a correct estimate of their own marginal tax rate (section 2). The more complex a tax rule is or is presented, the worse is the subjects' quality of judgment and decisions. Consequently, market efficiency can be affected (section 3). In several experiments, a negative relation between the marginal tax rate and labor supply is observed. But this even occurs when the tax revenue is paid back to the subjects and the effective tax burden is zero. And subjects tend to base their labor decisions on a mix of gross and net wage. Labor supply is more reactive to a labor tax than to an equivalent consumption tax (section 4). In most experiments subjects realize the incidence of an indirect tax when the tax is levied on the other market side (non-salient tax). Nevertheless, in some studies this only takes place through learning effects in repeated decisions (section 5). A number of experiments reveal that tax morale is typically higher than predicted by theory. On the other hand, they confirm the theoretical findings in so far as tax morale is an increasing function of audit probability and penalty. Political participation also reduces evasion (section 6). We have not found any empirical research on fiscal drag. From experiments and archival studies on money illusion and perceived inflation it can be concluded that a misperception of the tax burden is most probable after an extensive or extreme revision of tax legislation (section 7).

With respect to the external validity of effects which have been observed in laboratory experiments we have to add a twofold caveat. First, all reported experiments have been made with individuals, not with teams. Therefore, it should be clear that we cannot draw conclusions from these studies for corporate decision-making. It is well known that most firms consult their tax departments or tax consultants to back up important investment decisions. In such cases, we do not expect to observe a strong perception bias. Second, in a number of studies an observed perception bias disappears when test persons make repeated decisions; learning effects improve perception and the quality of decisions. Thus, in reality a

perception gap will most probably occur in non-recurring decision or right after a radical change of the legal or economic environment.

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