


Mental Accounting and Tax Compliance: Experimental Evidence for the Effect of Mental Segregation of Tax Due and Revenue on Compliance

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Abstract

Taxes are a burdensome and tedious issue for self-employed who have just started their business. The present research suggests mental accounting as a measure for self-employed to keep track of their financial activities. Based on prospect theory, we argue that the mental segregation of taxes due from net income affects a taxpayer's reference point in the compliance decision and results in higher tax compliance. Findings from a laboratory experiment confirm this prediction. Further, we show that relevance of mental tax accounting is higher when the tax due is not specified externally as it is the

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case in pay slips provided to employees. The individual tendency toward mental segregation of tax due and net income is positively related to the sex and age of respondents, their attitudes toward taxpaying, and their experiences gathered in the course of the experiment.

Keywords

mental accounting, tax compliance, tax evasion, voluntary compliance, self-employed

At the beginning [when we started our business], we simply spent all money. As soon as we got something, we thought: 'cool, let's go on holiday. But as naïve as we were, you shouldn't start a business . . . (Statement from interviews with self-employed taxpayers reported in Muehlbacher and Kirchler 2013, 419)

The self-employed are a special group of taxpayers. They are harder to tax than employees whose income is reported by a third party, and consequently—opportunity makes the thief—they are more prone to tax evasion than others (Kirchler 2007; Kleven et al. 2011; Slemrod 2007). Particularly in the first years after starting a business, finding a way to reduce the tax burden seems to be tempting. Unexperienced entrepreneurs feel restricted in their managerial decisions and tend to set more actions to reduce or avoid taxes (Kirchler 1999). Taxes are a tedious issue while trying to succeed, a struggle that often ends after a short time. In Austria, for instance, after three years 20 percent of newly founded businesses are dismissed, after five years 32 percent; the average drop-out rate after five years for the whole European Union is 50 percent (Wirtschaftskammer 2014). One of the reasons for early bankruptcy seems to lie in planning and administering the money flow. Entrepreneurs often have never learned how to keep accurate books and how to deal with legal issues. In an information brochure for business start-ups, the Austrian Economic Chambers (2014) warn young entrepreneurs about a major pitfall in handling their tax due: in the first year after starting a business, tax prepayments are typically based on self-reported estimations of the expected profit for the current period. Reporting lower expected gains than actually aspired to the tax office would nicely reduce financial constraints during the start-up phase and postpone part of the real tax due next year. However, if real revenue exceeds the estimation, the subsequent year missing taxes from last year and tax

prepayments for the current period are due. The resulting tax bill often becomes a serious problem for small business start-ups, and in the information brochure for business founders, it is explicitly recommended that they put at least 30 percent of revenues in an extra bank account to avoid unpleasant surprise (Wirtschaftskammer 2014). However, keeping track of one's finances and putting aside enough money in time require a high degree of self-control.

The research presented here studies mental accounting (Thaler 1999) as a measure for self-employed taxpayers to keep control over their finances. We show that individual differences in how taxes are mentally processed explain tax compliance and that mental accounting strategies are learned by experience with paying taxes. To the best of our knowledge, we present the first experimental evidence for the effect of mental accounting on tax compliance.

Mental Accounting and Individual Differences

Mental accounting is defined as “[...] the set of cognitive operations used by individuals and households to organize, evaluate, and keep track of financial activities” (Thaler 1999, 183). One of the theory's core assumptions is that income and expenses are grouped into different mental accounts. Committing oneself to specific budgets for “Food,” “Rent,” or “Entertainment” should help keep control over expenses. Indeed—and by contrast to the notion of fungibility in traditional economics—it seems to matter in which category expenses occur and how money is labeled. Participants in a study by Heath and Soll (1996) indicated, for instance, that they are less willing to buy a theater ticket after having bought a sports ticket (same category) for \$50 in the same week than after having spent the same amount for an inoculation against the flu (different categories). Fogel (2009) showed that income from a “serious” source (e.g., a health insurance refund) is likely to be spent for “serious” expenses such as paying bills and saving, whereas money from a “frivolous” source (e.g., a birthday gift) is used for buying clothes and spending on oneself. Although keeping mental accounts seems to produce irrational spending behavior in some situations, its actual purpose is to keep control of expenses (Thaler 1999). Mental accounting should make it easier not to spend too much money on things one likes and to save enough money for one's less attractive but necessary expenses.

Most empirical studies on mental accounting have varied the situation in which a decision should be taken. For instance, in the classical theater ticket

study by Kahneman and Tversky (1984), participants in one experimental treatment indicated whether they would buy another ticket after having noticed the loss of a ticket bought in advance (same category). In another treatment, participants were more willing to buy a ticket after learning they had just noticed the loss of a dollar bill of similar value as the theater ticket (no specific category). However, the extent to which individuals operate mental accounting as a way to keep track of financial activities seems to vary (Antonides, de Groot, and van Raaij 2011; Muehlbacher and Kirchler 2013, in press). A psychological measure for the individual disposition to engage in mental accounting (Muehlbacher and Kirchler in press) moderates the effect of Kahneman and Tversky's (1984) theater ticket scenario. Only individuals with high values on this mental accounting scale seem to differentiate between the loss of the ticket and the loss of a dollar bill. Moreover, the measure moderates the effect of income source on spending category, as described in Fogel (2009). Although research on individual differences in mental accounting is scarce, it seems that the extent to which mental accounting strategies are pursued varies from person to person.

Mental Accounting and Taxes

In previous research, the concept of mental accounting has been frequently applied to explain behavior related to various aspects of taxation. Feldman (2010) showed that withholding smaller amounts for income tax decreases the likelihood that a tax refund is invested in a tax-preferred retirement account. Drawing on mental accounting theory, she argued that the resulting higher monthly income is perceived as a budget increase in the mental consumption account, and money from this account is myopically spent by the households. In a related study applying hypothetical choice scenarios, Chambers and Spencer (2008) found that monthly tax refunds would be typically spent for monthly expenditures, whereas a yearly refund received as a lump sum is more likely to be saved or used to pay back debts. Jackson et al. (2005) analyzed almost 70,000 tax returns and reported that taxpayers receiving a tax refund were charged higher fees by their tax preparers than taxpayers owing additional payments of taxes. They point out that from the perspective of mental accounting theory, expecting a tax refund could increase the willingness to accept higher fees. Because costs for the tax preparer and the expected tax refund occur in the same mental account, the bills can be mentally deducted from the expected refund. Hence, overpayments of taxes in professionally prepared tax returns likely occur with intent.

Research on the role of mental accounting for tax compliance is relatively scarce. Ashby and Webley (2008a, 2008b) conducted interviews and focus groups with hairdressers, beauticians, and taxi drivers about their compliance with reporting tips as income. Most participants confessed low compliance, in part because they perceived tips as a gift from their customers rather than mentally categorizing this money as taxable income. Adams and Webley (2001, 208–9) reported an interesting statement from an interview study with small business owners: “[Value-added tax] is not a cost to the business, we are just looking after the money for the government. There is no point worrying about paying. It is their money.” Whereas other participants in the interviews perceived value-added taxes as an imposition reducing the profit, this interviewee seemed to mentally segregate the tax due from turnover and expresses voluntary compliance. However, mental accounting of value-added taxes may differ from the administration of other taxes such as the income tax. Whereas the former is a flat tax paid by customers in the course of the transaction, income tax rates are normally progressive and the true liability is not known until the end of the year. Mental processing of tax liabilities in general—including value-added tax and income tax—was more systematically studied in Muehlbacher and Kirchler (2013). In interviews with self-employed taxpayers, they found similar statements as in Adams and Webley’s (2001) study indicating some form of mental tax accounting. The majority of the participants expressed mental segregation of the tax due from the revenue, for instance, by stating “From the past years I know approximately how much money I have to put aside for taxes” (Muehlbacher and Kirchler 2013, 419). Others seemed to keep no separate mental account for taxes, as indicated in statements such as “Taxes do not really cross my mind when I see the revenue” (Muehlbacher and Kirchler 2013, 419). Based on the interviews, a psychological scale measuring the individual tendency toward mental integration or segregation of the tax due was developed for a follow-up study. Mental segregation was found to be positively related to age, attitudes toward taxes, and self-reports about tax compliance. Keeping a separate mental account for the tax due seems to increase compliance.

An explanation for the positive relation of tax compliance and mentally segregated accounts is provided by prospect theory (Kahneman and Tversky 1979). In prospect theory, it is assumed that decision outcomes are evaluated in relation to a reference point that divides the value function in a loss and a gain domain. The reference point may be the current asset position, an expectation, or an external stimulus provided by the decision frame. Hence, which outcome is perceived as a loss is a highly subjective matter.

In general, because prospect theory's value function is steeper for losses than for gains and because it has diminishing sensitivity in both domains, the prospect of a gain leads to risk-averse choices, whereas the threat of a loss increases the willingness to take risks. Prospect theory has often been applied in tax research (e.g., Dhimi and al-Nowaihi 2007; Schepanski and Kelsey 1990; Yaniv 1999), for instance, to explain the withholding phenomenon. Underwithheld taxpayers facing the loss of additional payments are more prone to evasion than overwithheld taxpayers expecting the subjective gain of a tax refund. The difference can be interpreted as the effect of employing current rather than expected asset position as reference point in the compliance decision (Schepanski and Shearer 1995). Another study on whether current or expected asset position better represents taxpayers' reference point concludes that both asset positions seem to be commonly used as reference, and which one is applied depends on the decision situation and on individual expectations (Kirchler and Maciejovsky 2001). A situation where expectations serve as a reference point is when income was earned by hard work. With every investment that a job demands, expectations for satisfactory monetary compensation increase, and these aspirations may serve as reference in the compliance decision (Kirchler et al. 2009).

Mental accounting could play a key role in determining which reference point is employed in the tax compliance decision: expecting the tax due and keeping a separate mental account for taxes (i.e., to mentally segregate taxes from the revenue) would mean that expected net income serves as a reference point. From this perspective, evading taxes would yield an additional gain in net income but also a painful loss in case of an audit and a fine. By contrast, without such a mental tax account (i.e., to mentally integrate taxes and revenue), gross income would serve as reference point and paying taxes would be perceived as a loss. By evading taxes, the loss could be repaired, and with gross income as reference point, the risk of paying a fine in case of an audit seems less threatening. Hence, the high compliance observed in Muehlbacher and Kirchler (2013) among the self-employed who mentally segregated the tax due from the revenue can be interpreted as the effect of employing expected net income as a reference point in the decision whether to evade taxes.

Research Questions and Hypotheses

The present research is the first experimental approach to study the role of different mental accounting strategies for tax compliance of self-employed taxpayers. On the basis of prior research, it is assumed that the

self-employed differ with regard to their mental processing of taxes. Either the tax due is mentally segregated from the revenue and expected net income serves as reference point in the compliance decision or the tax due and net income are integrated to the same mental account, making gross income the reference point. Based on prospect theory (Kahneman and Tversky 1979) and on prior research (Muehlbacher and Kirchler 2013), it is hypothesized that:

Hypothesis 1a: Tax compliance is higher in the case of mental segregation of the tax due than in the case of mental integration.

However, it is assumed that the relevance of mental accounting for compliance depends on the decision situation. For instance, in contrast to self-employed taxpayers, employees typically receive pay slips from their employers with details regarding the gross income, tax payments, and resulting net income. Thus, for self-employed taxpayers who have to do these calculations on their own, stringent accounting is of higher relevance than for other taxpayers. Accordingly, it is expected that:

Hypothesis 1b: The positive effect of mental segregation on tax compliance is more pronounced in situations in which calculations of the tax due are not externally provided.

If budgets are tight, keeping a mental tax account and saving part of the revenue for tax payments could also affect other decisions. Dedicating a budget to a specific mental account for the tax due makes it easier to track how much net income is available for spending on private expenses. Thus, apart from increasing tax compliance, mental segregation of the tax due from other revenue should also reduce the risk of overspending and going bankrupt. Hence, it is assumed that:

Hypothesis 2a: Mental segregation of the tax due and the revenue reduces the risk of bankruptcy.

As before, an interactional effect of the decision frame and the extent the tax due is mentally segregated is expected for going bankrupt:

Hypothesis 2b: The effect of mental segregation on overspending is more pronounced in situations in which calculations of the tax due are not externally provided.

Another purpose of the present research is to explore for correlates of keeping a mental tax account. In a prior study (Muehlbacher and Kirchler 2013), mental segregation of the tax due and the revenue was positively correlated with age and attitudes toward taxes. When mental tax accounting affects tax compliance, it is important to gather knowledge about what determines mental accounting practices.

Method

Participants

The sample was recruited by announcements in the university building and in social networks on the Internet. Overall, 128 subjects followed the invitation to participate in the lab experiment. Of these subjects, 56 percent were females and 44 percent were males and the mean age was 25.80 years (standard deviation = 7.67 and range = 18 to 70 years). Four percent studied economics or business administration. Participants were remunerated according to their choices in the experiment. Average earnings were 9.34 Euro (EUR; standard deviation = 2.49 and range = 0.60 to 15.00 EUR).

Experimental Procedure

The experiment was designed to simulate nine business years of self-employed taxpayers. In each year, participants earned taxable income by completing one or more tasks and faced several consumption opportunities. At the end of each period, taxes had to be paid on the income gained during the business year. Except for the work tasks to be completed, the study was fully computerized by means of the experimental software z-tree (Fischbacher 2007).

An overview of the experimental procedure is provided in figure 1. In each period, participants completed between two and four word search tasks to earn their income; the exact number of work tasks in period 1 to 9 was either A: 2, 3, 4, 3, 2, 4, 4, 2, 3 or B: 3, 2, 4, 4, 2, 3, 4, 3, 2. In a matrix of 10 × 10 letters, at least two of four specified words had to be found to receive a payment of 300 experimental currency units (ECU). Since the number of tasks varied each period, total achievable gross income per period ranged from 600 to 1,200 ECU.

Each work task was followed by an opportunity to consume all or part of the income just earned. After receiving the 300 ECU for completing one task, participants were offered the opportunity to buy “Life points” for 100 ECU a piece. These Life points were introduced to mimic the various

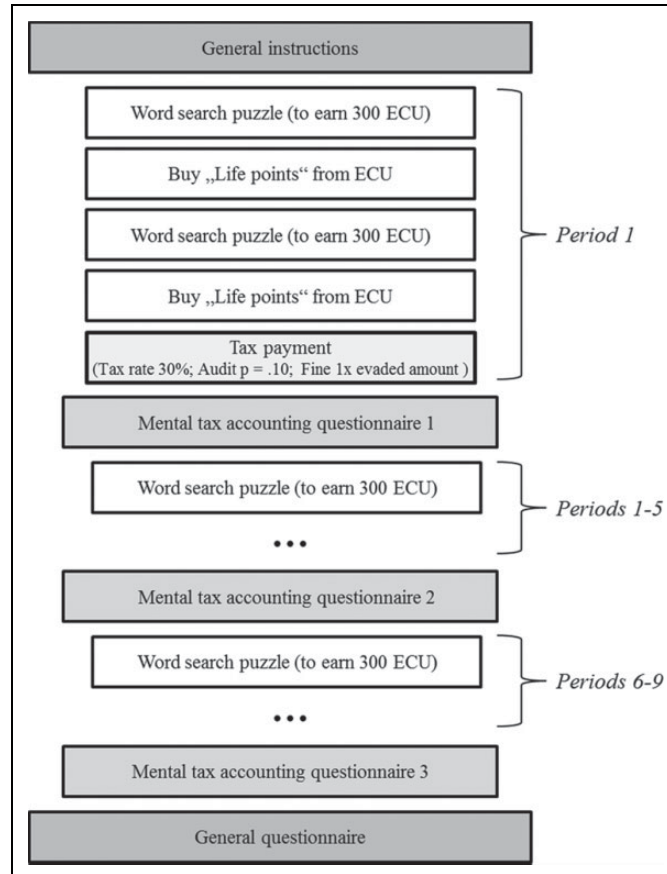


Figure 1. Experimental procedure.

Note: Number of puzzles varied each period between 2 and 4 (income = 600–1,200), audits occurred either in period 3 or 6.

hedonic opportunities in real life that can be realized by one's earnings. Life points were changed into EURs (1 Life point = 1 EUR) as remuneration for participating in the experiment; hence, participants were incentivized to invest the maximum amount of income in Life points. Note, however, that taxes were due at the end of each period, and to save enough money for the tax payment it was necessary that the amount spent for Life points did not exceed the net income. If participants spent more than their net income, they had no other choice than evading their tax due. In case of an audit, Life

points had to be sold to settle the fine. However, the price achieved by reselling Life points was much lower (1 Life point = 50 ECU) than for what they had been bought (1 Life point = 100 ECU). By contrast, if participants decided to save more of their income for the tax due than necessary, any remaining ECU after paying taxes were automatically changed into Life points at the end of each period. The price to be paid for Life points at the end of a period was higher (1 Life point = 200 ECU) than when buying immediately, providing an incentive to consume income early. Hence, participants had to decide whether and how many Life points they should buy at each opportunity and how much they wanted to save for their tax due. Table 1 provides an overview of the prices for buying and selling Life points at the various occasions.

Life points gathered within one period were not transferred to subsequent periods. Participants were endowed with a bonus of three Life points at the start of each period. The number of opportunities for buying further Life points varied with the number of work tasks between two and four. The smallest amount possible to be invested in Life points was 1 ECU, and its maximum was restricted by the participant's actual wealth level (i.e., the cumulative gross income earned in the respective period minus the amount already spent for Life points). Depending on the number of tasks completed in the respective experimental period and participants' choices, participants ended up with different amounts of Life points indicating their personal success in the experimental "life." After all nine experimental periods ended, one period was drawn randomly by the computer, and the amount of Life points achieved in this period was paid in EUR (1 Life point = 1 EUR) as remuneration for participation.

At the end of each experimental period, 30 percent income taxes had to be paid. Participants were informed about the final tax due (ranging from 180 to 360 ECU depending on the experimental period) and were asked to indicate the amount of taxes they wanted to pay. They learned that with a probability of 10 percent, their tax payment would be checked, and in case of evasion, the difference to the full tax due and a fine equal to the amount evaded had to be paid. Periods to be audited were selected prior to the experiment. Half of the participants were audited in period 3, and the other half in period 6.

If participants spent too much on Life points and therefore did not have enough money to settle their tax due (i.e., bankruptcy), they had to evade. In case of bankruptcy and an audit resulting in a fine, a mandatory exchange of Life points and ECU was undertaken. The amount of Life points necessary to pay the fine was automatically sold from the points acquired before. However, as mentioned earlier, the selling price for Life points was much lower than the price at which they had been acquired (see table 1).

Table 1. Prices for Buying and Selling Life Points.

Occasion	Price for 1 Life point (ECU)
Buying at consumption opportunity	100
Selling to pay a fine	50
Buying at the end of experimental period	200

Figure 2 consists of two computer screen examples, (a) and (b), showing financial summaries for two years. Screen (a) is for the gross income framing condition, and screen (b) is for the net income framing condition. Both screens display Life Points, Annual Gross Income (so far), Annual Net Income (so far), Tax Due (so far), and Current Wealth.

(a) Year 1	
Life Points:	5.00
Annual Gross Income (so far):	300
Current Wealth:	100
(b) Year 2	
Life Points :	5.00
Annual Net Income (so far) :	210
Tax Due (so far) :	90
Current Wealth :	100

Figure 2. (a) Example of computer screen for gross income framing condition. (b) Example of computer screen for net income framing condition.

An overview of participants' finances was provided on the right-hand side of the computer screen; examples are shown in figure 2a and b. The screen showed the number of Life points acquired, the annual income achieved so far, and the current wealth level defined as the cumulative gross income in the current period minus the money spent on Life points. Depending on the experimental condition, income was either presented in terms of gross income (figure 2a) or as net income (figure 2b). In the latter case, the tax due accumulated by then was also included in the overview. In the net income condition, it should be easier for participants to keep track of their financial activities and to know precisely how much money is available for spending on Life points. In the gross income condition, however, participants were required to calculate for themselves what remains after taxes and before investing in Life points. To minimize miscalculations, each participant was provided with a pocket calculator.

To summarize, three parameters were manipulated in the experiment. The most important treatment was whether income was displayed as gross

income or as net income. Further manipulations regarded whether audits occurred in period 3 or 6, and how the number of work tasks and therefore income varied in the course of the experiment. These manipulations were done solely for the purpose of counterbalancing their potential effects.

Measures

Besides observing participants' *tax compliance* (or tax payments in relation to the complete tax due), their expenses for Life points were transformed into a dichotomous variable indicating whether participants were still liquid when taxes were due. If at the end of one period they had enough money to pay their full tax due, the *bankruptcy* variable was set to 0, otherwise to 1.

Further, participants responded to short surveys at different points of time during the experiment. A seven-point Likert-type scale (1 = *I don't agree* and 7 = *I do agree*) measuring *mental tax accounting* was presented three times during the experiment: first, after participants completed their first tax report in period 1, next after period 5, and finally after period 9. The four items of the mental tax accounting scale were adapted from Muehlbacher and Kirchler (2013) for context of the artificial situation of earning income and paying taxes in the lab ($\alpha_{\text{period1}} = .67$, $\alpha_{\text{period5}} = .76$, and $\alpha_{\text{period9}} = .75$; *When I earn money, I automatically think about the incurring tax due; I know relatively well how much money I have to put aside for the incurring taxes; I think it is essential to put aside the necessary amount of money to pay the tax due; and I never really look upon the money I pay as income tax as my money*). A high value on this scale indicates the practice of mentally segregating the tax due from the net income and a low value indicates mental integration. In other words, an individual scoring high on this scale seems to have understood that solely part of her income is available for private expenses.

A final postexperimental questionnaire assessed participants' tax morale by measuring attitudes toward tax paying. For this purpose, the five-item measures for *voluntary compliance* ($\alpha = .80$) and *enforced compliance* ($\alpha = .83$) by Kirchler and Wahl (2010) were presented in a seven-point Likert-type scale (1 = *I don't agree* and 7 = *I do agree*).

Results

Tax Compliance

Tax compliance was defined as the percentage of taxes actually paid relative to the full tax due, ranging from 0 percent (i.e., no taxes paid at all)

to 100 percent (i.e., full compliance). Average tax compliance across all subjects, all conditions, and all periods was 62.97 percent (standard deviation = 42.38 percent). Descriptive statistics for all measures and their zero-order intercorrelations are presented in table 2.

Data were analyzed in long format ($n = 1,152$) by means of Tobit regression analysis (see table 3). Tobit regression was applied because tax compliance is censored at 0 and 100 percent. Table 3 shows normal estimated standard errors for regression coefficients as well as robust estimates of the error, being adjusted for 128 clusters at the individual level. The regression model includes all parameters from the experiment (experimental income, framing of income, experimental period, and fined in previous period), participants' sociodemographic characteristics (age, sex, and being a student of economics), and the measure for mental tax accounting; since mental tax accounting was measured at three points of time during the experiment, its value from experimental period 1 was used as predictor for period 1 to 4, the value from period 5 for period 5 to 8, and the value from period 9 for period 9. Further, to test whether mental tax accounting is of lesser importance when earnings were presented as net income, the interaction term of framing of income and mental accounting was included.

As expected, framing of income, mental tax accounting, and the interaction of both are related to tax compliance. Compliance was higher when income was displayed as net income and when the measure for mental tax accounting indicated mental segregation of the tax due. The significant interaction suggests that mental accounting was more important for compliance when income was displayed gross (or when participants had to compute by themselves the net income available for spending) than when income was presented net. Significance of the interaction remains the same when applying robust standard errors.

Compliance was further related to experimental period and experimental income and seems to drop sharply after having received a fine in the previous period (i.e., a bomb crater effect; see Kastlunger et al. 2011; Mittone 2006). These relations are also significant when testing with robust standard errors. In addition, age and being an economics student were related to compliance. However, with robust standard errors, age and the study discipline do not reach statistical significance.

Bankruptcy

Participants were classified as bankrupt when expenses for Life points during one business year exceeded annual net income. In this case, the subject

Table 2. Zero-order Interrelations (Pearson Coefficients).

Variable	M	SD	1	2	3	4	5	6	7	8	9	10	11
1. Compliance ^a	62.97	42.38											
2. Bankruptcy ^b	.42	.49	-.69***										
3. Mental tax accounting	4.29	1.49	.31***	-.28***									
4. Framing of income ^c	.50	.50	.03	-.04	-.02								
5. Experimental period	5.00	2.58	.06*	-.04	.12***	.00							
6. Experimental income	900.00	245.06	.06*	.03	-.03	.00	.00						
7. Fined previously ^e	.06	.24	-.15***	.11***	-.08**	-.02	.12***	.00					
8. Age	25.80 ^d	7.67	.12***	-.10***	.20***	.05 ^d	.00	.00	-.03				
9. Sex ^f	.56 ^d	.50	.01	.01	.07*	.09 ^d	.00	.00	.04	-.04 ^d			
10. Economics student ^g	.04 ^d	.19	.07*	-.05	.01	-.04 ^d	.00	.00	-.01	-.07 ^d	-.15 ^d		
11. Voluntary compliance	4.78 ^d	1.28	.25***	-.19***	.27***	-.01 ^d	.00	.00	-.07*	.03 ^d	-.02 ^g	-.19** ^d	
12. Enforced compliance	4.00 ^d	1.52	-.04	-.04	.18***	-.02 ^d	.00	.00	.01	-.03 ^d	.07 ^d	.01 ^d	-.18** ^d

Note: $n = 1,152$ observations.

^aDefined as amount of taxes paid in relation to the full tax due.

^b0 = liquid, 1 = bankrupt.

^c0 = net income, 1 = gross income.

^d $n = 1,152$ observations except for where marked with ^d $n = 128$.

^e0 = not fined in previous round, 1 = fined in previous round.

^f0 = male, 1 = female.

^g0 = other study, 1 = economics.

† $p \leq .10$. * $p \leq .05$. ** $p \leq .01$. *** $p \leq .001$.

Table 3. Pooled Tobit Regression Predicting Tax Compliance.

Variable	Tax compliance				
	Coefficient	SE	t	Robust SE	t
Mental tax accounting	14.97	3.88	3.86***	8.72	1.72†
Framing of income ^a	-86.63	23.88	-3.63***	56.11	-1.54
Mental tax accounting × framing of income	23.57	5.44	4.33***	11.92	1.98*
Experimental period	2.82	1.49	1.90†	1.26	2.25*
Experimental income	0.03	0.02	2.11*	0.01	2.84**
Fined previously ^b	-67.58	16.08	-4.20***	16.84	-4.01***
Age	1.76	0.58	3.03**	1.14	1.55
Sex ^c	6.87	7.79	0.88	17.08	0.40
Economics student ^d	70.84	22.41	3.16**	55.87	1.27
Constant	-73.37	26.76	-2.74**	52.44	-1.40
σ	111.27	5.24		11.29	
Log likelihood			-2,692.97		-2,692.97
			$\chi^2 = 189.84***$		$F = 4.62***$

Note: $n = 1,152$ observations. Criterion was tax compliance defined as amount of taxes paid in relation to the full tax due. SE = standard error; Robust SE = standard error adjusted for 128 clusters at individual level.

^a0 = net income, 1 = gross income.

^b0 = not fined in previous round, 1 = fined in previous round.

^c0 = male, 1 = female.

^d0 = other study, 1 = economics.

† $p \leq .10$. * $p \leq .05$. ** $p \leq .01$. *** $p \leq .001$.

did not have enough money left to cover all or part of the tax due. Across all conditions and periods, bankruptcy occurred in 42.4 percent of observations.

Data were analyzed in long format ($n = 1,152$) by logit regression analysis (see table 4). Again both types of standard errors for the coefficients are reported in table 4: the normal estimates based on the pooled data and robust standard errors based on clusters at the individual level. As in the previous regression analysis, the model includes the experimental parameters (experimental income, framing of income, experimental period, and fined in previous period), sociodemographic variables (age, sex, and being a student of economics), and the measure for mental tax accounting and its interaction with framing of income.

The likelihood of going bankrupt was associated with the mental tax accounting measure and its interaction with framing of income,

Table 4. Pooled Logit Regression Predicting Bankruptcy.

Variable	Bankruptcy				
	Coefficient	SE	z	Robust SE	z
Mental tax accounting	-.26	.06	-4.04***	.13	-2.06*
Framing of income ^a	.76	.39	1.92†	.80	0.95
Mental tax accounting × framing of income	-.23	.09	-2.59**	.17	-1.38
Experimental period	-.02	.02	-0.84	.02	-0.91
Experimental income	.00	.00	0.87	.00	0.95
Fined previously ^b	.73	.27	2.73**	.23	3.10**
Age	-.02	.01	-1.78†	.02	-0.94
Sex ^c	.05	.13	0.42	.26	0.21
Economics student ^d	-.65	.35	-1.82†	.73	-0.88
Constant	1.17	.43	2.70**	.72	1.63
Log pseudolikelihood			-727.05		-727.05
			$\chi^2 = 115.92^{***}$		$\chi^2 = 46.93^{***}$

Note: $n = 1,152$ observations. Criterion was bankruptcy dummy coded as 0 = liquid, 1 = bankrupt. Coefficient in log-odds units. SE = standard error; Robust SE = standard error adjusted for 128 clusters at individual level.

^a0 = net income, 1 = gross income.

^b0 = not fined in previous round, 1 = fined in previous round.

^c0 = male, 1 = female.

^d0 = other study, 1 = economics.

† $p \leq .10$. * $p \leq .05$. ** $p \leq .01$. *** $p \leq .001$.

indicating that if income was displayed gross, mental accounting was more important than when income was displayed net. The relation with the framing dummy was only marginally significant. When applying the robust estimation of standard errors, framing of income and the interaction term do not reach statistical significance, but the measure for mental tax accounting does.

Further, bankruptcy was related to being fined in the previous round and with marginal significance also to age and to studying economics. However, age and studying economics are not significantly related to bankruptcy when applying robust standard errors.

Correlates of Mental Tax Accounting

Mental tax accounting was measured three times during the experiment (periods 1, 5, and 9). As mentioned earlier, its value from experimental

period 1 was used for period 1 to 4, the value from period 5 for period 5 to 8, and the value from period 9 for period 9. The average across all conditions and periods was 4.29 (standard deviation = 1.49).

The correlations of mental tax accounting and all other variables of the study are presented in table 2. Mental tax accounting was positively related to experimental period and participants' age, suggesting that experience with paying taxes enhances segregation of the tax due. Female participants have a stronger tendency for segregation, and receiving a fine seems to enhance mental integration of income and taxes. As in a previous study (Muehlbacher and Kirchler 2013), mental tax accounting was positively related to the two measures of tax morale: voluntary and enforced compliance.

Discussion

Mental accounting theory (Thaler 1999) describes a measure for keeping track of financial activities. By categorizing expenses to separate mental accounts, an individual should avoid spending too much on things he or she likes, in order to save enough money for less attractive but necessary payments. Prior research suggested that mental accounting also plays a role for tax compliance (Adams and Webley 2001; Ashby and Webley 2008a, 2008b; Muehlbacher and Kirchler 2013). Based on prospect theory (Kahneman and Tversky 1979), we argued that keeping a mental account dedicated to taxes would lead to employing expected net income as a reference point in the compliance decision and consequently would lead to higher tax compliance.

In line with our predictions, a psychological measure for the individual tendency toward segregating the tax due from other revenue was positively related to observed compliance in our experiment (Hypothesis 1a). As expected, the relation was stronger when the tax due was not calculated by the computer and displayed on the screen than when the budget available for spending had to be calculated by participants on their own (Hypothesis 1b). Further, mental accounting seems to prevent bankruptcy; participants without a mental tax account were prone to spend more than their net income for private consumption (Hypothesis 2a) and consequently faced liquidity problems when taxes had to be paid. The hypothesized interactional effect of framing income as net or gross and mental tax accounting (Hypothesis 2b) reached statistical significance only

for the pooled data, but not when adjusting standard errors for clusters at the individual level.

These findings are in line with previous research reporting a positive relation of tax compliance and mental segregation of the tax due from the revenue (Adams and Webley 2001; Muehlbacher and Kirchler 2013). However, prior studies relied on self-reports about compliance behavior, a method that is frequently criticized for being affected by social desirability and for allowing only limited inferences about causality when collected in cross-sectional designs (e.g., Gërxhani 2007). Thus, the experimental evidence presented here provides important additional empirical support for the relevance of mental accounting in tax compliance decisions.

A further finding of our study regards correlates of mental tax accounting. Since our analysis is explorative and based on zero-order correlations, our observations can only cautiously be interpreted. In line with previous findings (Muehlbacher and Kirchler 2013), participants' ages and attitudes toward taxpaying were positively related to our measure for mental segregation of the tax due. Older taxpayers seem to pursue more favorable mental accounting strategies, and segregation of the tax due is associated with positive attitudes toward taxpaying. In addition, mental segregation of the tax due increases over experimental periods and therefore with experience in taxpaying. It seems that accurate administration of tax issues is a skill that is learned over time. In contrast to the prior survey study, in the present experiment mental tax accounting was additionally related to participants' sex, with females having a stronger tendency for mental segregation.

Experiments in tax compliance research must be viewed with some caution. Though behavior of participants is typically incentivized and thus should be less prone to social desirability, external validity of experimental observations has often been doubted. For instance, the artificial situation in the lab has been criticized, sometimes on the basis that paying taxes to the experimenter has no real meaning. Also, the representativeness of student samples for the general population of taxpayers is sometimes questioned. Typically students are younger than the average taxpayer, they come from wealthier families, and—most importantly—they have little experience in paying taxes (for summaries of the critique on tax compliance experiments, see Alm, Bloomquist, and McKee 2015; Muehlbacher and Kirchler in press; Torgler 2002). However, for our research purpose, having participants with a lack of experience in paying taxes seems advantageous. Using naive subjects such as students allowed for observing the development of mental

accounting strategies after starting a business. Experienced taxpayers would have brought strategies from their daily routine to the lab.

A further limitation of our study regards the experimental manipulation of framing of income. In the net income treatment additionally to providing the information how much net income is available for private spending, also the tax due was explicitly indicated on the computer screen. This could have induced a moral imperative that was not present in the gross income treatment and have triggered moral considerations in the tax compliance decision.¹

Our findings show the relevance of mental accounting for tax compliance of self-employed taxpayers. As noted in the introduction, particularly the first years of being self-employed bear several financial pitfalls that often lead to bankruptcy. In contrast to employees, the self-employed have to handle their tax issues on their own and are well advised to put aside enough of their income to settle the tax due. In specialized courses addressing business start-ups, the self-employed should be reminded of their tax liabilities and could be instructed in accurate bookkeeping and administration of tax payments. The lesson to be learned in such courses was verbalized by a participant in an earlier study: “I transfer about 40 percent of revenues immediately to an extra bank account for taxes and social insurance, to avoid unpleasant surprises” (Muehlbacher and Kirchler 2013, 419).

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