



# Misperception of chance and loss repair: On the dynamics of tax compliance

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## Abstract

Previous experimental studies on tax behavior have been particularly concerned with determining the absolute effect of detection rate and punishment on tax filing, leading to mixed results. In this paper, we shed some additional light on the effectiveness of audit probability and sanctions by drawing upon a dynamic setting with particular focus on the time lag between audits. Our results showed that tax compliance decreased immediately after a random audit, suggesting that subjects were prone to misperception of chance. Sanctions decreased compliance to a lesser extent; they were, however, associated with the tendency of subjects to repair their losses by increasing their capital stock.  
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## 1. Introduction

A large number of experimental studies on tax behavior was inspired by, or related to, the seminal theoretical papers by Allingham and Sandmo (1972) and Srinivasan (1973),

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drawing upon the standard economic framework. According to this paradigm, taxpayers weigh the expected utility of the benefits from successful tax evasion with the uncertain prospect of detection and punishment. An increase in audit probability as well as an increase in tax penalty is assumed to increase tax compliance. Previous experimental studies on tax behavior have been particularly concerned with determining the absolute effect of detection rate and punishment on tax filing; the dynamic process of compliance, however, received considerably less attention (see, however, [Hessing, Elffers, Robben, & Webley, 1992](#), for field evidence and [Van Baal, 2004](#), for computer simulations).

In the realm of experimental studies, one noticeable and recent exception is the work by [Mittone \(2006\)](#), who reports findings suggesting that tax compliance drops immediately after an audit. The author labels this phenomenon the “bomb crater” effect. In war, troops under heavy enemy fire hid in the craters of recent explosions, believing that it would be highly unlikely for the next bombs to fall exactly at the same spot in a short time span. Something similar seems to happen in the context of tax audits. A taxpayer who was recently audited seems to believe that the likelihood of a subsequent audit is highly unlikely; therefore, the risk of evasion appears low. After several filing periods, however, the perceived likelihood of audits increases again and so does compliance.

One mechanism that might account for this finding is misperception of chance or the gambler’s fallacy. Individuals assume that a random event, such as an audit, is more likely to occur because it has not happened for a while or it is less likely to occur because it recently happened. A competing mechanism that might also explain the bomb crater effect is loss repair. In their review on the determinants of tax compliance, [Andreoni, Erard, and Feinstein \(1998\)](#) conclude that the small and sometimes contradicting effects of audits on compliance might induce taxpayers to “make them want to evade more in the future in an attempt to ‘get back’ at the tax agency” (pp. 844). In other words, taxpayers experiencing audits and fines might try to repair their ‘losses’ by engaging in tax evasion in subsequent filings.

In this paper, we investigate the dynamics of tax compliance in a stylized experimental setting with the aim of shedding new light on the competing mechanisms for the bomb crater effect: misperception of chance and loss repair. For this purpose, we conducted two experiments that varied audit probabilities, sanctions, and the time lag between past audits. Although a stylized experimental setting might not be the perfect vehicle for studying ‘real-world’ tax behavior, it provides a satisfactory tool for evaluating the *relative* merits of competing explanations in a controlled environment ([Alm, 1999](#)).

## 2. Related literature

The standard economic analysis of tax compliance solely stresses exogenous variables, like audits and sanctions as well as tax rates and income effects ([Kirchler, 2007](#); [Torgler, 2002](#)). Experimental evidence, however, on the impact of audit probability and tax penalty on compliance are ambiguous ([Fischer, Wartick, & Mark, 1992](#)). [Spicer and Lundstedt \(1976\)](#), for instance, confirmed the influence of audit probability, but not the impact of sanctions. Also, [Baldry \(1987\)](#) showed that the threat of detection increases compliance rates, punishment, on the other hand, did not influence tax behavior. [Friedland, Maital, and Rutenberg \(1978\)](#) demonstrated that large fines are more effective deterrents than small ones, even when audit probability is reduced proportionally. [Alm, Sanchez, and Juan \(1995\)](#) showed that compliance is positively related to audit rate, at least for large fines. [Beck, Davis, and Jung \(1991\)](#)

found that individual risk attitude moderates the effects of audit probabilities and sanctions on compliance, and [Alm, McClelland, and Schulze \(1992\)](#) conclude that the rate of compliance rises in a nonlinear way as the probability of detection increases.

Possible sources of ambiguity might be the relevance of endogenous variables ([Webley, Robben, Elffers, & Hessing, 1991](#)), such as social norms ([Alm, McClelland, & Schulze, 1999](#); [Wenzel, 2005](#)) or justice concerns ([Murphy, 2004](#); [Taylor, 2003](#); [Wenzel, 2003](#)). Alternatively, remaining in the context of audits and fines, [Andreoni et al. \(1998\)](#) conclude that audits may have little specific deterrent value, because they “may not turn out as badly as taxpayers initially fear. For example, if an audit fails to uncover non-compliance that is present or if a substantial penalty is not applied to discovered non-compliance, a taxpayer may conclude that it pays to cheat” (p. 844). Indeed, knowledge about the dynamics of audits and compliance is largely tentative.

Most studies on audit probabilities and tax compliance assume that the probability of audits is constant. Few studies investigated the effects of past audits on future behavior as well as the sequential effects of repeated audits. The experience of being audited in one year and the consequences of an audit may change taxpayers’ perceptions of future audits and the perceived success of detecting non-compliance. On the one hand, prior audits could increase the subjective salience of audits and punishments, which lead to more compliance in the future due to an “availability-heuristic effect” ([Tversky & Kahneman, 1974](#)). On the other hand, if audits are not successful in detecting non-compliance, taxpayers may come to the conclusion that auditors have only limited capacities to detect evasion and that clever evasion techniques will likely not be uncovered. Consequently, the risk of evasion might be estimated low, and hence, evasion is more likely in upcoming years.

Personal experience with being audited has been shown to increase compliance in experimental studies (e.g., [Spicer & Hero, 1985](#); [Webley, 1987](#)). As [Spicer and Hero \(1985, p. 266\)](#) put it, “taxpayers do not engage in optimising strategies in making tax evasion decisions. Instead, they apparently use heuristics or ‘rules of thumb.’ In particular, the experience of being audited appears to lower levels of tax evasion even where the likelihood of an audit is completely random.” [Hessing et al. \(1992\)](#) report survey data for the years 1983 to 1986 from taxpayers in The Netherlands. The results indicate that taxpayers, who received one or more corrections for errors, tended to perceive a higher level of certainty that evasion in large amounts, but not in smaller amounts, would be detected by the authorities. [Andreoni et al. \(1998\)](#) quote a 1987 study by Long and Schwartz who examined data of the US IRS, involving a group of taxpayers who were audited in 1969 and in 1971. The earlier audit was only marginally effective in reducing the frequency of subsequent non-compliance. The average magnitude of non-compliance among those who continued to evade in 1971 remained unchanged.

Besides having the effect of increasing compliance or leaving it unchanged, under certain conditions audits might actually decrease compliance due to learning effects. As [Antonides and Robben \(1995\)](#) put it, “besides a deterring effect of auditing, a learning effect might take place since undesirable behaviour is punished. On the contrary, if audit probability is low, successful attempts at tax evasion are positively reinforced” (p. 624). Taxpayers may exert considerable effort to analyze their experience with tax authorities; they may try to predict audits and understand tax auditors’ strategies (see, for instance, [Bayer, 2006](#)) for a game-theoretic analysis of a similar idea.

The importance of analyzing the dynamics of tax compliance has recently been stressed by [Mittone \(2006\)](#), who uncovered a systematic drop in compliance rates immediately after

tax audits in a series of experimental studies (see also Guala & Mittone, 2005). Mittone labelled this tendency the bomb crater effect, referring to troops who hid under heavy fire in craters of recent explosions, believing it would be highly unlikely for the next bombs to fall exactly in the same spot.

Participants in experimental studies on tax compliance, who believe that an audit is less likely immediately after experiencing an audit, might be prone to misperception of chance, since in these experiments it is usually common knowledge that the actual probability of an audit is constant across filing periods. However, misperception of chance is not the only explanation for the drop of compliance rates after an audit. This behavioral tendency is also in line with loss repair. If taxpayers were found to be non-compliant, then usually on top of repaying taxes, they have to pay fines. In order to ‘repair’ these (unanticipated) losses, taxpayers might engage in non-compliance in subsequent filing periods.

In this paper, we designed two studies to test these two competing hypotheses for the bomb crater effect: misperception of chance and loss repair after fines. For this purpose, we investigated the dynamics of compliance by varying audit probabilities, sanctions, and the time lag between past audits.

We conjecture that audits constitute not only a reaction to past tax compliance, but audits and their consequences represent also a cause for future behaviors. Particularly, we hypothesize that the effect of audits crucially depends on the time lag between past audits, and the naïve generation of taxpayers’ expectations as when the next audit is likely to occur. Naïve reasoning might predict that the probability of consecutive, yet independent, audits is low; a violation of independence according to probability theory (for a discussion of biases of chance see, for instance, Hastie & Dawes, 2001). More specifically, if participants are prone to misperception of chance, we predict that (a) non-compliance is significantly lower immediately after an audit and (b) compliance returns gradually to its baseline level, as observed during an audit. This gradual adjustment process is predicted to be a quadratic function.

To see this, assume that the probability of an audit is  $1/3$ . Hence, the probability of not being audited in a given tax period is  $2/3$ . The probability of not being audited for two consecutive periods is  $(2/3)^2 = 4/9$ , of not being audited for three consecutive periods is  $(2/3)^3 = 8/27$ , etc. We predict that participants have an intuition for these probabilities and adjust their level of compliance accordingly. If the probability of an audit is small, taxpayers are expected to engage in a relatively high rate of non-compliance. However, if taxpayers observe long streaks without audits, they are expected to assume that the probability of an upcoming audit is relatively high, increasing taxpayers’ compliance. Thus, during audits we expect a comparatively high rate of compliance; immediately afterwards a decrease, and as streaks without audits increase, a gradual rise. This pattern of compliance is captured by a quadratic response function.

In addition to misperception of chance, we conjecture that the (unpleasant) experience of audits and their consequences in the case of detected evasion induce a perceived financial loss, which taxpayers may wish to repair by engaging in future risky behavior, for instance, by exhibiting non-compliance. Differential risk proneness as predicted by prospect theory (Kahneman & Tversky, 1979) has been shown to be associated with tax compliance in previous studies on withholding effects (Hasseldine & Hite, 2003; Kirchler & Maciejovsky, 2001; Schepanski & Shearer, 1995). If individuals react to sanctions by repairing their perceived losses, non-compliance should rise as sanctions increase. More specifically, and similar to the case of misperception of chance, we predict that (a)

non-compliance is significantly lower immediately after being fined for tax evasion and (b) compliance returns gradually to its baseline level, as observed during an audit.

Taken together, we predict that reactions to audits and sanctions are strongest immediately after experiencing a fine and fade out in subsequent filings. In other words, we predict a three-way interaction effect of audits, fines, and the time lag between audits on tax compliance. We test these predictions by varying the audit probability and the severity of fines. We predict that in the case of frequent audits, compliance will be low immediately after an audit and will increase rapidly over the course of subsequent tax filings. In the case of less frequent audits, compliance is expected to be low after an audit and will increase comparatively slowly. This pattern is assumed to be particularly pronounced if sanctions are high.

Our predictions were tested in two laboratory experiments. In the first experiment we allowed participants to earn their income endogenously in a competitive market. Contrary to most previous experimental studies, compliance was therefore not investigated based on “windfall” money, distributed to participants by the experimenters, but on participants’ real effort. After each trading period, participants were asked to declare their earnings, separately for sales revenues, resulting from selling assets, and for dividends paid for holding assets. In the second experiment, we focused on the effects of tax audits on compliance, and ensured that the random device, which determined whether tax declarations were audited or not, was believed to be truly random by all participants. In order to better analyze the dynamics of compliance, we also allowed for more filing periods and for more variation of the time lags between audits, based on chance outcomes.

### 3. Experiments

#### 3.1. Experiment I

##### 3.1.1. Participants

Overall, 72 students from the University of Vienna and the Vienna University of Economics and Business Administration participated in six sessions of an experimental asset market with 12 subjects each. On an average, participants earned Euro 14.39 ( $SD = 17.37$ ). Twenty-six females and 46 males, aged 19–30 ( $M = 22.17$ ,  $SD = 2.65$ ), participated in the study. An experimental session took about 2 h and 15 min.

##### 3.1.2. Experimental design and procedure

After instructing the participants about the market and trading procedures, they participated in a computerized continuous double auction, conducted using the software z-Tree (Fischbacher, in press). A general description of continuous auctions can, for instance, be found in Davis and Holt (1993), and a market similar to the one that we employed in this study is described by Kirchler and Maciejovsky (2002). To avoid end-effects, participants were informed in the instructions that 16–20 trading periods would be performed (with a random termination probability of 20% in each of the last five periods). Subjects were also informed that after each trading period they would be asked to declare their income (subject to a 50% tax rate), separately for sales revenues and dividends. Finally, participants were told that the audit probability would either be 15% in one experimental treatment or 30% in the other treatment. Penalties were either 50% or 100% of the evaded income. The two variables, i.e., audit probabilities and penalties, were varied in a between-subjects design. Taxable sales revenues were defined as the positive difference between the selling

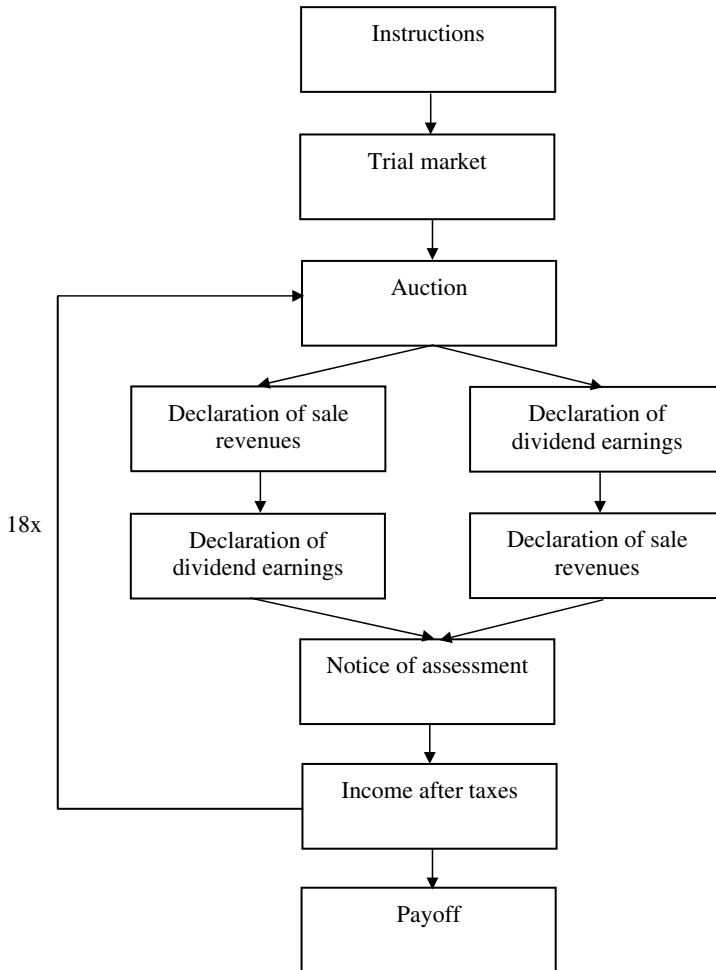


Fig. 1. Sequence of events in the experiment.

price of an asset and its purchase price. The sequence of events in the experiment is displayed in Fig. 1.

Because the main focus of this paper was to investigate the dynamics of compliance, particularly the contrast of misperception of chance and loss repair, it was our aim to make the gambling aspect of the tax decisions salient. A convenient way to attain this goal is simply to redistribute tax yields to the experimenter, implying that taxes are lost money to subjects.<sup>1</sup> Overall, the markets opened for 18 periods, each lasting 120 s. The number of periods was determined according to the above described termination mechanism and was

<sup>1</sup> Redistributing tax revenues to taxpayers would constitute a setting similar to a public goods game. Recent research has shown that in these games social motivations, such as reciprocity and conditional cooperation, play a major role (e.g., Fehr & Gächter, 2000). We believe that these motivations obfuscate the impact of audit probabilities and sanctions on compliance, and therefore decided against such a setting.

applied to all six sessions (i.e., all markets ended in the same period (18)). In each period, participants were endowed with 300 ECU (experimental currency units), whereby 10 ECU were equivalent to seven Euro cents, and five risky assets. Dividends for the assets were determined randomly in each period according to a pre-specified distribution (they were 0, 30, 60, 90, or 120 ECU, each with a probability of 20%), which was common knowledge to participants.

To ensure comparability between the six sessions, audits were randomly selected prior to the experiment. In the low-audit condition, declarations were audited after periods 3 and 12, whereas in the high-audit condition the respective audit periods were 3, 5, 8, 12, and 16.

### 3.1.3. Results and discussion

Our predictions of the three-way interaction effect were tested by a mixed  $2 \times 2 \times 5 \times 2$  analysis of variance with compliance rates as dependent variable. The factors were audit probability and sanctions, trading periods after an audit (0–4), and as a control factor, type of income, with sales revenues versus dividends. The first two factors were between-subjects factors, the last two within-subjects factors.

The analysis revealed that income type had no effect on tax compliance. Neither the main effect of income nor the interaction effects involving income reached significance. With respect to our predicted three-way interaction effect our results were insignificant ( $F(4, 65) = 0.91$ ;  $p = 0.46$ ). However, the two-way interaction between audit probability and time lag between audits was highly significant ( $F(4, 65) = 5.32$ ;  $p < 0.01$ ;  $\eta^2 = 0.27$ ) and the two-way interaction effect between sanction and time lag between audits approached significance ( $F(4, 65) = 2.30$ ;  $p = 0.07$ ). Effect sizes suggest that audits have a stronger impact on compliance than fines. The hypothesized quadratic relation between audit probability and time lag between audits as well as between sanction and time lag was only significant for the former ( $F(1, 68) = 5.39$ ;  $p < 0.05$ ;  $\eta^2 = 0.08$ ), but not for the latter ( $F(1, 68) = 0.12$ ;  $p = 0.73$ ). Finally, the main effects for time lag between past audits ( $F(4, 65) = 4.38$ ;  $p < 0.01$ ;  $\eta^2 = 0.23$ ) and audit probability ( $F(1, 68) = 30.40$ ;  $p < 0.001$ ;  $\eta^2 = 0.33$ ) were significant as well. Results of the significant two-way interactions are presented in Figs. 2 and 3. These figures depict compliance rates under high and low audit probability and high and low sanctions, respectively. Average compliance rates are shown for audit periods as well as the first four subsequent periods following an audit.

The results confirm that in the high-audit condition tax compliance was generally higher than in the low-audit condition. Moreover, compliance decreased sharply after an audit and increased slowly in the next three consecutive trading periods in the high-audit condition. In the low-audit condition compliance decreased after an audit steadily (see Fig. 2). It might well be that observing more than four subsequent filing periods would reveal an increase of compliance rates also in the low-audit condition. However, our design did not allow for such an analysis.<sup>2</sup> These results suggest that participants' compliance decisions are driven by misconception of the audit probability, as shown in the literature on gambler's fallacy.

A less clear picture emerged in the sanctions condition, which, as described above, did only reach statistical significance at  $p = 0.07$ . However, it seems that participants showed a tendency to be more responsive to fines in the high-sanction condition than in

<sup>2</sup> We will come back to this issue in Experiment II.

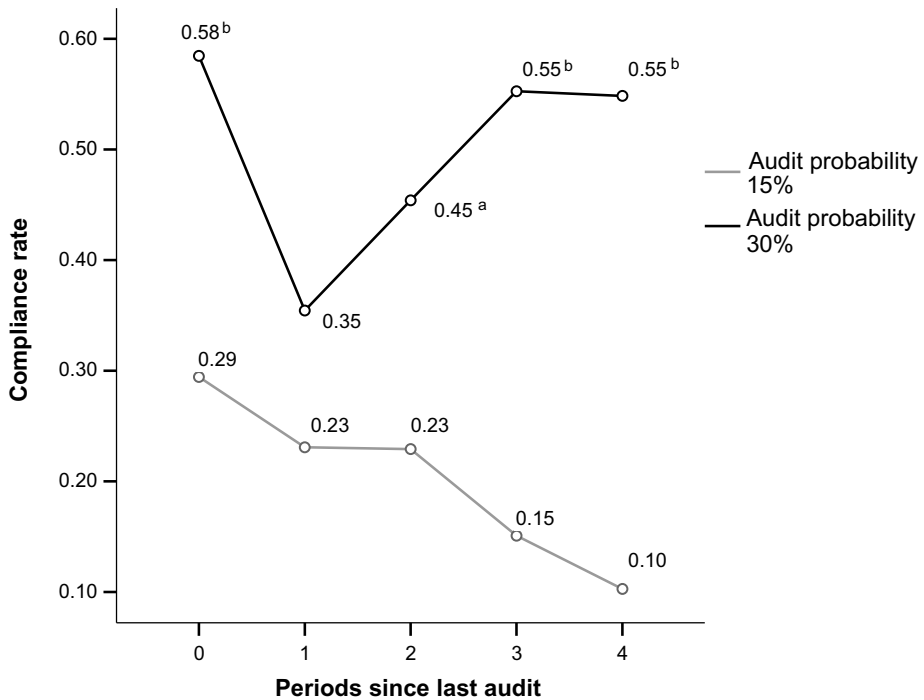


Fig. 2. Compliance rate by audit probability and periods since last audit. Note: <sup>a</sup> denotes significance at the 5% level, and <sup>b</sup> denotes significance at the 1% level. These significance levels refer to the comparisons of the means of the two treatments holding the filing period constant. For example, the compliance rate of 0.58 in the high-audit condition is significantly higher than the corresponding rate of 0.29 in the low-audit condition.

the low-sanction condition (see Fig. 3). The sharp decrease of compliance after an audit could in part be due to loss repair. Although tax compliance did not decrease more if sanctions were high, support for our conjecture was found in participants' trading behavior. Following an audit with detected evasion and fines, participants sold a significantly higher proportion of their assets (40%) as compared to an audit with no detected evasion and thus, no fines (16%;  $\chi^2(1) = 59.99, p < 0.001$ ). Rather than repairing a loss by cutting one's tax share, participants seemed to have attempted to replenish their cash holdings by selling their assets.

Taken together, our findings indicate that misperception of chance is the stronger determinant of the bomb crater effect than loss repair. However, a few aspects of the experimental design and the experimental procedure render some of the conclusions doubtful. For instance, participants might not have believed that audit probabilities were communicated accurately, and that audits occurred truly randomly according to the stated probabilities. We therefore designed a second experiment, trying to replicate our findings in a more transparent setting. In this experiment, we used a randomization device that guaranteed that every single participant truly believed in its unbiasedness. Moreover, we introduced post-experimental questionnaires and interviews to explore the motives and inferences of participants. For this purpose, we restricted ourselves to only one level of audit probability (1/3) and one level of sanction (50%).



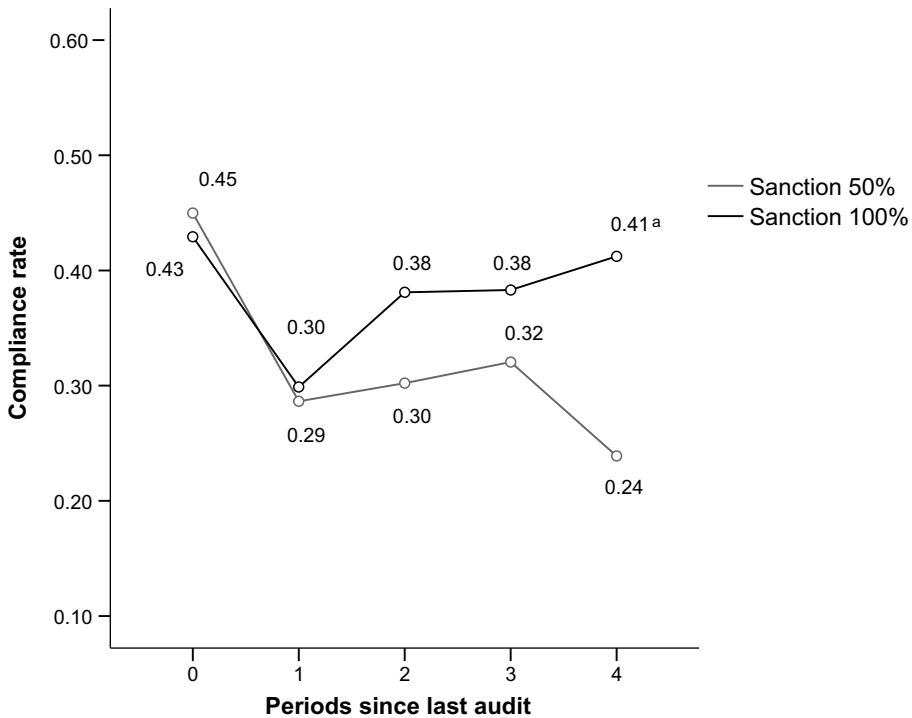


Fig. 3. Compliance rate by sanctions and periods since last audit. *Note:* <sup>a</sup> denotes significance at the 5% level. This significance level refers to the comparisons of the means of the two treatments holding the filing period constant. The compliance rate of 0.41 in the high-sanction condition is significantly higher than the corresponding rate of 0.24 in the low-sanction condition.

## 3.2. Experiment II

### 3.2.1. Participants

Overall, 50 students from the University of Vienna participated in five experimental sessions. Participants earned, on average, Euro 7.14 ( $SD = 3.99$ ). Thirty-nine females and 11 males, aged 19–43 ( $M = 21.98$ ,  $SD = 3.64$ ), participated in the study. An experimental session took about 1 h.

### 3.2.2. Experimental design and procedure

At the beginning of each of the 20 filing periods, participants were endowed with some cash. The exact amount was randomly drawn from a uniform distribution ranging from 80 ECU to 120 ECU, whereby 100 ECU was equivalent to 10 Euro. In each period, participants had to decide how much of the endowment they wanted to declare. The tax rate was 40%. After all participants had filed their declarations, one subject was selected (in the sequence of the seating order) to determine whether an audit would take place or not. The participant was given a die. If he or she rolled a 1 or a 2, then all declarations were audited, otherwise no audit occurred. The audit probability was therefore 1/3. In case of an audit, the experimenters determined for each individual whether they underreported their

earnings. In these cases, participants had to pay the owing taxes and were fined with an additional 50% of the underreported income.

The experiment only started after all the participants had solved correctly four sample problems. At the end of the experiment, one of the 20 filing periods was randomly selected. The participants were paid their earnings of that particular period in cash, and were asked to fill in a short post-experimental questionnaire. In this questionnaire, participants were asked to indicate whether they believed that the randomization device was truly random. It also contained questions designed to elicit participants' motives for their filing decisions. In addition, a subset of the participants was interviewed on the phone about similar questions some weeks after the experiment was conducted. The phone interview allowed us to inquire about a participant's reasoning more thoroughly.

### 3.2.3. Results and discussion

The randomly determined number of audits ranged from five to eight in the five experimental sessions. The average declaration was 59.39% (SD = 25.01%) of the endowment, and did not systematically co-vary with the number of audits per session. One participant evaded in all the 20 periods, and two participants always declared fully. The remaining 47 participants showed varying compliance rates across periods.

Fig. 4 displays the compliance rate in percent as a function the time lag since the last audit. In one of the five sessions, we had a maximum time lag of 11 filing periods, in the other sessions the maximum lags were four, four, six and eight. In Experiment I, we speculated about a possible gradual return of compliance also in the low-audit condition. There

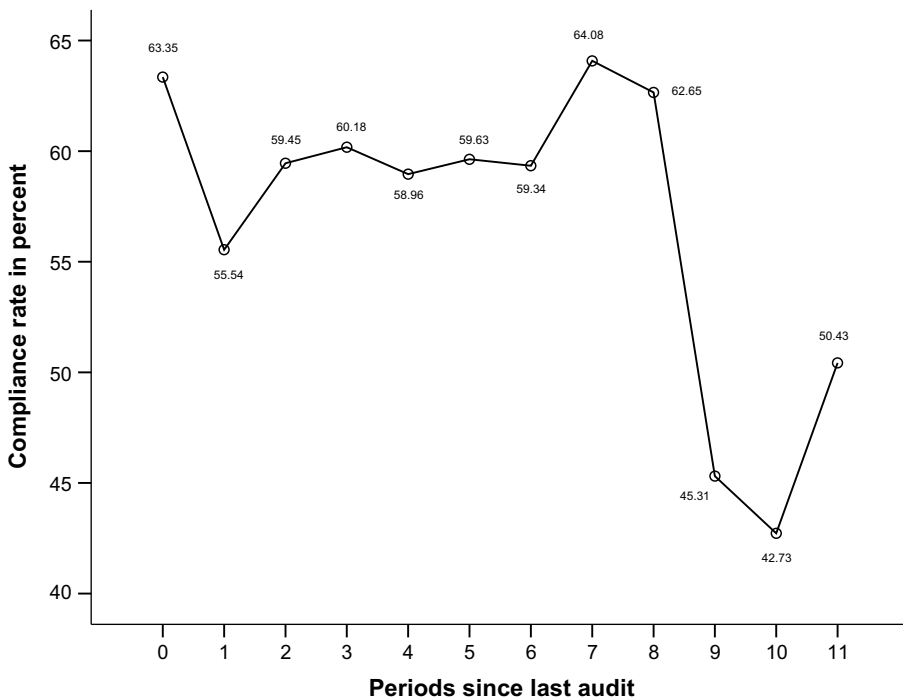


Fig. 4. Compliance rate in percent across periods since last audit.

we only had a maximum time lag of four filing periods. In this experiment Fig. 4, indeed, suggests that such an adjustment takes place, albeit only after seven periods. The means for periods 9–11 since an audit should be considered with great caution, because they are based on very few observations.<sup>3</sup>

As in Experiment I, we expected a significant drop of compliance in the filing period immediately after an audit as well as a gradual return of compliance to its baseline level across filing periods. This adjustment process was assumed to be quadratic. Our results confirm the first prediction. The average compliance rate dropped from 0.63 in the period of an audit to 0.56 immediately after an audit ( $t(49) = 2.51$ ;  $p < 0.05$ ;  $d = 0.72$ ). Also, the hypothesized quadratic adjustment of the compliance rate across filing periods was confirmed. This process occurred within two filing periods since the last audit ( $F(1, 49) = 4.36$ ;  $p < 0.05$ ;  $\eta^2 = 0.08$ ). Both results were robust across observation times, suggesting that participants did not adjust their behavior when gaining more experience.

Our second hypothesis predicted that the bomb crater effect might also be driven by loss repair. The negative consequences of detected tax evasion, and the resulting fines, might induce taxpayers to engage in risky behavior, for instance, by exhibiting non-compliance in subsequent filings. To test this hypothesis, we contrasted the drop of compliance rates for honest taxpayers, i.e., those who fully declared their income, with dishonest ones, i.e., those who underreported. Loss repair can be detected if the drop of compliance for the dishonest taxpayers is significantly more pronounced than the corresponding drop for the honest taxpayers. Our results do not confirm this hypothesis. We did not detect any systematic differences in the compliance rates of honest and dishonest participants after audits.

Taken together, these findings suggest that the main mechanism, underlying the bomb crater effect, is misperception of chance. Loss repair was not observed. The results of our post-experimental questionnaire and phone interviews confirm this conclusion. All the participants indicated that they believed that the randomization device used in the experiment, a die, was truly unbiased. Furthermore, the majority of participants (70%) indicated that they did not believe that an audit conditional on just having been audited would be less likely than an unconditional audit. Still, many subjects indicated that despite having known that the objective probability of an audit stayed constant from period to period, they felt more compelled to believe that the conditional probability of an audit given an audit actually declined.

#### 4. Conclusions

In this paper, we investigated the dynamics of tax compliance in two simple experimental studies with the aim of shedding new light on the competing mechanisms for the bomb crater effect (Mittone, 2006). The bomb crater effect is the behavioral tendency of participants in experimental studies to decrease their compliance rates immediately after a tax audit. Two mechanisms that might account for this effect are misperception of chance and loss repair.

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<sup>3</sup> Despite the small number of observations, the drop of compliance did not disturb the hypothesized quadratic trend as mentioned later. However, it might be that the drastic decline in compliance was due to an end effect: subjects in the experiment might have tried to increase their earnings by evading taxes in the last periods (although, in fact, only *one* of the periods was payoff relevant).

Misperception of chance refers to the behavioral tendency of participants to assume that a random event, such as an audit, is more likely to occur because it has not happened for a while or it is less likely to occur because it recently happened. Loss repair refers to the desire of participants to offset previous (unexpected) losses, such as fines associated with detected tax evasion, by engaging in more risky behavior, for instance, by underreporting one's income in subsequent tax declarations.

The results of two experiments suggest that misperception of chance is the stronger determinant of the bomb crater effect than loss repair. Misperceiving random events even occurred in a setting, in which it had been perfectly ensured that all the participants truly believed in the unbiasedness of the randomization device. Many even acknowledged that the objective probability of an audit remained constant across filing periods. Yet, they felt that an audit was less likely conditional on having had an audit immediately before. Our results also indicate that higher sanctions marginally increased compliance relative to lower sanctions. Loss repair, however, was only observed indirectly. Participants who were fined for tax evasion were more likely to sell their assets, probably with the intention of replenishing their cash holdings.

How do our results compare to the literature? Our findings replicate [Mittone's \(2006\)](#) bomb crater effect under more general conditions, ensuring that all the participants in the experiment truly believed in the randomization device. Our findings are also in line with [Baldry \(1987\)](#), suggesting that the threat of detection increases compliance rates, punishments, on the other hand, have a considerably weaker effect. [Hessing et al. \(1992\)](#) observed, based on survey results, that there are three types of taxpayers; those who never evade taxes, those who habitually evade, and finally, those who evade now and then. Our results show a similar pattern, albeit the proportion of participants who engages in evasion over the course of our experiments is extraordinarily high. Finally, while our experiments demonstrate that the perception of audit probability is a function of the time lag since the last audit, [Van Baal \(2004\)](#) uncovers that these perceptions are also a function of the neighborhood structure in computer simulations. He demonstrates that an increase in the severity of punishment can have detrimental effects on aggregate compliance, since the individual decision to comply might influence the perceived audit probability of neighboring 'citizens,' leading them to defect.

Experimental research on tax compliance serves an important bridging function between theory and empirical research based on field data. Laboratory experiments allow important institutional variables, such as tax rates, audit probabilities, and fines, to be controlled by the experimenter ([Torgler, 2002](#)). Moreover, laboratory experiments provide an important tool for studying policy changes ([Alm, Jackson, & McKee, 1992](#)), for instance, the effects of an increase of tax rates or audit probabilities on compliance. Finally, official data on tax behavior are considered sensitive and are often difficult to obtain ([Cowell, 1991](#)). Still, some concerns remain: for example, laboratory experiments are usually artificial and abstract ([Spicer & Thomas, 1982](#)), they sometimes use neutral and sometimes loaded instructions ([Abbink & Henning-Schmidt, 2006](#)), and they often draw on student samples with little prior experience in tax decisions ([Baldry, 1987](#)). Although these concerns are important, they do not qualify the main contribution of the present paper, i.e., the contrast of two competing explanations for the bomb crater effect, since "there is [] no reason to believe that the cognitive processes of students are different from those of 'real' people" ([Alm, 1999, p. 758](#)).

Yet, venturing to speculate about real-world implications of our findings requires acknowledging the limitations of experimental research when studying tax compliance.

These speculations suggest that if taxpayers become risk-inclined immediately after an audit, then auditing repeatedly might cause a robust reduction of evasion, and auditing self-employed taxpayers at the beginning of their business might lead to more compliance throughout taxpayers' business cycles than random audits or audits at a later stage of their business life. Since non-compliance was consistently found to be higher in younger taxpayer samples than in older samples (see, for instance, Mason & Calvin, 1978), audits at the beginning of a business serve additionally as controls of the younger samples, as they are likely to be over-represented in the groups of people starting a business.

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