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« Fighting Income Tax Evasion with Positive Rewards: Experimental Evidence »

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Fighting Income Tax Evasion with Positive Rewards: Experimental Evidence

by

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Abstract: This paper provides experimental evidence regarding the influence of positive rewards on income tax evasion behavior. In particular, we experimentally test the impact of positive rewards in form of individual lottery winnings for honest taxpayers. Among other things, we find that these positive rewards lead to a significantly higher rate of tax compliance. Moreover, there are two gender effects. Males not only evade taxes to a much higher extent than females, they also show a stronger positive response to the lottery scheme. This allows us to draw some interesting policy recommendations.

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1 Introduction

Sun and Wind once had a fierce argument over who would be the more powerful. As they were arguing, they saw a man walking on a secluded road wearing a hat and a coat. It so happened that they agreed to demonstrate their powers to each other by convincing the said man to take off his hat and coat. Immediately the Wind started blowing toward the man. However, once the man realized that the Wind was blowing, he pressed his hat a bit stronger to his head and tightened his coat. So the Wind blew a bit harder. But the harder the Wind blew, the more the man pressed his hat to his head and tightened his grip on the coat. Finally, the Wind had no choice but to concede that he could not convince the man to take off his hat and coat. Then, when the Sun took its turn she smiled to the man and sent her warm rays to him. As the Sun was shining and the man felt the warm rays of the Sun he decided trying to do without his hat. The Sun continued to smile and shine and the man, being happy with wearing no hat, finally decided to take off his coat as well.

The problem of tax evasion is usually approached in a 'Wind' fashion, that is, tax evasion is fought with negative sanctions such as fines or even imprisonment for non-honest taxpayers (e.g. see Allingham and Sandmo 1972). However, success of these measures has been rather limited (e.g. see Frey and Jegen 2001; Christie and Holzner 2006). To this extent, the Sun-and-Wind fable motivates the general idea of the present paper: Does the additional option of giving *positive* rewards to honest taxpayers allow for designing a mechanism that eliminates or at least significantly reduces tax evasion? In fact, the purpose of this paper is to develop such a mechanism and to test run it in an experimental setting.

The paper proceeds as follows. The next section provides some background on tax evasion and positive rewards. Section three introduces the experimental design. Section four

deals with strategy issues, section five provides experimental results and the final section offers policy recommendations and concludes.

2 Background

Following Gary S. Becker's (1968) work on the economics of crime and Arrow's (1970) work on optimal portfolio analysis under uncertainty, Allingham and Sandmo (1972) developed the first model of rational, utility maximizing taxpayers making their decisions under uncertainty. They conclude that an increase in deterrence parameters, e.g. probability of detection and level of the penalty on undeclared income, will *c. p.* always lead to an increase in actually declared income. Yet, the theoretical analysis of Allingham and Sandmo (1972) has been criticized on the grounds that their findings are not in line with empirical evidence on income tax compliance. For example, based on real values of taxation and deterrence parameters, Alm, McClelland and Schulze (1992, p. 22), argue that individuals pay more taxes than expected utility theory suggests.[1] They conclude that some other factors inevitably influence income tax behavior. Such factors are discussed, for example, as 'appellation of informal penalties' (e.g. see Hasseldine and Kaplan 1992; Violette 1989), and 'positive strategies or appeals to conscience' (e.g. see Slemrod, Blumenthal and Christian 2001; Blumenthal, Christian and Slemrod 2001; Hasseldine and Bebbington 1991). In fact, a large fraction of relevant literature is devoted to the question of why people pay taxes. As a consequence reciprocity, characteristics of the tax exchange, legitimacy and respect between taxpayers and tax authorities, moral or a sense of civic duty are considered as important aspects in tax compliance level explanations (e.g. Andreoni, Erard and Feinstein 1998; Feld and Frey 2002, 2003, 2007). Bazart (2000, 2002) provides a comprehensive overview concerning relevant

[1] Assuming that individuals have a low relative risk aversion, they conclude that less than 14% of actual incomes should be declared. In fact, risk aversion has to be increased to extreme values to end up with more realistic figures of 70% to 90% of income declared.

literature, Torgler (2002) surveys the literature on experiments dealing with tax moral and tax compliance and Slemrod and Yitzhaki (2002) offer a more general overview regarding tax avoidance, tax evasion and tax administration.

Positive incentives for honest taxpayers are a comparatively new issue. In the early nineties, Falkinger and Walther (1991) introduced positive rewards as a complementary measure besides traditional deterrent measures. They show that the combination of the deterrent system (i.e., a penalty on evaded tax) with a pecuniary reward (i.e., a reward per dollar of paid taxes) is welfare improving in comparison with a pure deterrent system as described in Allingham and Sandmo (1972). One can also find early attempts to give a role to positive rewards in some studies focusing on optimal taxation design such as the ones developed by Mookerjee and Png (1989), Cremer and Gahvari (1996), Chandar and Wilde (1998), and Boadway and Sato (2000). The aforementioned theoretical works have been complemented by empirical research. Some studies have focused on the impacts of rewards compared to punishment in cooperation issues (e.g. see Andreoni, Harbaugh, Vesterlund 2003; Walker and Halloran 2004); some focused directly on the tax evasion problem.

Regarding the tax evasion problem, positive rewards were first tested experimentally by Alm, Jackson, McKee (1992), who allowed for different reward schemes. Honest taxpayers could then either participate in a lottery scheme or, alternatively, could receive a fixed lump sum reward. Their conclusion confirmed the efficiency of positive incentives on taxpayers' tax compliance and underlines the efficiency advantage of the lottery scheme in ensuring honest reporting. Moreover, Torgler (2003) provided an experimental test of the relative impact of various factors (fiscal exchange, moral suasion, etc.), including positive rewards, on tax compliance. This field experiment was conducted in Costa Rica with taxpayers having different professions. The highest rate of tax compliance was achieved, in this experiment, under the positive reward scheme. It is worth noting, however, that the analysis of tax compliance regarding the control variable 'gender' did not show any considerable difference

between male and female subjects. In contrast, the results presented in section 5 do indicate a gender effect.

More recently, Feld and Frey (2007) have described the characteristics of the psychological tax contract existing between taxpayers and tax authorities and emphasized the need for a joint use of negative and positive incentives. Crowding theory (see Feld 1997) already justifies the use of a well designed combination of negative and positive incentives with the heterogeneity of taxpayers' types and motivations.[2] The theory assumes that any external action, positive reward and/or deterrence, can undermine or negatively affect the intrinsic motivation of the taxpayer to pay his taxes if they are perceived to be intrusive. The issue is then to design a mechanism that will be perceived as supportive and that would then raise intrinsic motivation and, as a consequence, lead to more tax compliance.

Thus, in line with the benefit principle of taxation, the tax exchange establishes a link between the taxpayers' contributions and the governmental provision of public goods (see Pickhardt 2006, 2005b). To this extent, the provision of public goods may favor taxpayers' honesty and Alm, Jackson and McKee (1992), as well as Alm, McClelland and Schulze (1992) provide some experimental evidence that supports this view. Yet, although the provision of public goods may be considered as a positive reward for taxpayers, it must be stressed that due to nonrivalness in consumption or the impossibility of applying the price-exclusion principle, non-honest taxpayers may benefit from the provision of public goods in exactly the same way as honest taxpayers do. Therefore, it is worth analyzing the influence of positive rewards that accrue exclusively to purely honest taxpayers and in a way that avoids

[2] The heterogeneity of taxpayers' types refers to the fact that the global population is made of honest and dishonest taxpayers. Measures described in the seminal work of Allingham and Sandmo are specifically designed to discourage dishonest taxpayers without considering the sub-population of honest taxpayers. Besides, being audited may have high psychological costs for an honest taxpayer and this is what Motivation Crowding Theory refers to.

any deviation from honest reporting due to social interaction (e.g. see Becker, Buchner and Sleeking 1987; Spicer and Becker 1980).

In principle, the experimental design which we introduce in the next section follows these routes, but with some modifications.

3 Experimental Design

The next subsection gives a general overview of the design and the following subsection introduces procedure details and links the design to Allingham and Sandmo (1972) as well as to the design of Alm, Jackson and McKee (1992).

3.1 General Aspects

Sessions were conducted in a non-computerized 'paper and pencil' fashion at the Chemnitz University of Technology, Germany and at the University of Montpellier, France. A typical session lasted about 90 minutes. Subjects were drawn from first year students of the business administration and economics faculty. There were seven subjects per session, with five subjects participating as 'acting subjects', one subject performing the role of the 'institution' and another subject performing the role of the 'public good calculator'. The two roles 'institution' and 'public good calculator' were performed by subjects with a view to keep the process transparent and credible for the acting subjects.

Each of the five acting subjects received an endowment or income of 100 tokens per round, i.e. $W = 100$, and was told that according to a *generally accepted rule* he or she is supposed to give up 20 of the 100 tokens in each round by submitting these 20 tokens to a third party called 'institution'. But it was made clear in the instruction sheet that, in principle: (i) each subject may choose any integer from the integer interval [0, 20], (ii) compliance with the 'give-20-rule' is randomly audited by the institution and (iii) a penalty applies, if it is found that a subject has not acted according to the rule. In the first block of six rounds all

voluntary tax payments to the institution plus enforced payments due to an audit are pooled together according to a certain technology and paid back to the subjects as a public good. The second block of six rounds is then characterized by an increase in the detection or auditing rate. However, subjects can freely choose between this higher auditing rate and a lower auditing rate. To encourage opting for the higher auditing rate, there is a positive incentive in form of an individual lottery winning for purely honest taxpayers. Finally, the third block is characterized by an increase in the tax rate on undeclared income (i.e. the penalty rate).

Regarding monetary incentives each subject received a show-up fee of five Euro. In addition, one of the five acting subjects was randomly selected at the end of the session and received one percent of his or her total earnings over the 18 rounds in cash. This total amount ranged from about 20 to almost 30 Euro. The institution and the public good calculator received another five Euro as compensation for not being able to participate in the one percent cash scheme. Monetary incentives were mentioned in the initial instruction sheet and, in addition, explained by the experimenter before the experiment started.

3.2 Procedure

After seating subjects conditions of anonymity were respected in all sessions. In addition, the ‘institution’ and the ‘public good calculator’ were always visually separated from the five acting subjects, so that any kind of identification was impossible. Each acting subject received an instructions sheet, an earnings record sheet and a submission form. The ‘institution’ and the ‘public good calculator’ received the same instructions as the five acting subjects and some additional instructions explaining their specific role and job in the experiment, they also received specific record sheets. All subjects were told to read the instructions sheet quietly. When everybody had finished readings the experimenter summarized the instructions orally and answered questions. The experimenter also asked subjects a few questions to check whether they had fully understood the instructions. Thereafter, the experimenter assigned an

ID-Number (1 to 5) to each acting subject. The instruction sheet also informed subjects that three blocks of six rounds each would be played and that they would receive new instructions after each block. Again, at the beginning of each block questions were answered after each subject had finished readings.

First Block: At the beginning of each round subjects choose the amount they wish to contribute to the 'institution' and simultaneously record this amount on their earnings record sheet and the submission form. Subjects are supposed to contribute 20 tokens of their income of 100 tokens, but may in principle choose any integer from the integer interval [0, 20]. Hence, the tax rate, θ, on declared income, X, is $\theta = 0.2$. Yet, for simplicity we have chosen the amount of tax due, θX, as the actual decision variable, rather then X as in Allingham and Sandmo (1972). But as θ is exogenously given and constant, the actual decision variable remains declared income, X, with $\theta X = 20$ implying $X = W$ and $\theta X = 0$ implying $X = 0$.

Subjects place their submission forms face down in front of them, with their ID-Number (1 to 5) written on the back of the form, and the experimenter collects these submission forms. Next, the 'institution' applies its auditing scheme. That is, the subject representing the 'institution' tosses a coin. If the coin shows tales no auditing takes place. However, if the coin shows its face value one card, in the first block, is drawn from a set of cards with numbers 1 to 5, which are taken from the popular UNO card game, and the subject with the corresponding ID-Number is audited. Hence, each subject may be selected for auditing with the probability, $\rho = 1/2 \cdot 1/5 = 0.1$. During an audit the institution learns the true income of the audited subject. If the institution finds that the subject has contributed less than 20 tokens, the tax rate on non-declared income, $\pi = 0.3$, is due. The institution records any amounts due on the relevant submission form and passes all forms (again face down) on to the 'public good calculator'.

The subject representing the 'public good calculator' then calculates the public good payoff, G, according to equation (1) in the first block:

$$\left(\sum_{i=1}^{n} C_i + D + P \right) \cdot \frac{\lambda}{n} = G \ , \qquad (1)$$

where the sum of C_i denotes the voluntarily declared contributions of all five subjects, and D and refers to the difference or reimbursement of evaded tax and P is the penalty paid by the audited subject if found to be a tax evader, λ can be interpreted as an efficiency parameter and n is the number of acting subjects. The calculation procedure in (1) represents a modified version of the aggregation technology 'average' and coincides with the technology 'summation' for the special case of $n = \lambda$ (see Cornes 1993). Following Samuelson (1954), the total public good payoff G then accrues simultaneously to all acting subjects according to (2):

$$G = G_1 = G_2 = \ldots = G_n \ , \qquad i = 1, 2, \ldots, n. \qquad (2)$$

where G_i refers to the public good payoff received by the i-th subject (see also Pickhardt 2006, with respect to (2) and Samuelson 1954). Once G is calculated, the experimenter announces G by writing G on a board so that all acting subjects can record G on their earnings record sheet. Thereafter, the acting subjects calculate their total earnings of that round. The next round then starts in exactly the same way as the first round with the experimenter distributing a new submission form to each acting subject. After a total of six rounds the first block is completed.

Second Block: In principle, the six rounds of the second block are run in much the same way as in the first block. The major difference is the introduction of a lottery scheme where lottery winnings serve as a positive reward for purely honest tax payers.

In particular, we allow subjects to choose freely between a low value of ρ and a somewhat higher value of ρ. If they wish to choose a low value of ρ they need to join the 'beta-group',

and if they wish to choose a somewhat higher value of ρ they need to join the 'alpha-group'. Coins are therefore tossed separately for the two groups. The procedure for the beta-group is exactly the same as in the first block, that is, *one* card is drawn from a stack of UNO cards representing the ID's or the beta-group members. However, if an audit takes place in the alpha-group, *two* cards from a stack of UNO cards representing the alpha-group members are drawn and the submission forms of the corresponding subjects are audited. To motivate subjects to join the alpha-group, their members are entitled to participate in the lottery scheme. In particular, alpha-group subjects that are audited (i.e. either one or two) and are found to be in full compliance with the 'give-20-rule', that is $C_i = \theta X = 20$, are entitled to continue with participating in the lottery scheme. If both audited subjects are entitled to continue, one card is drawn and the subject with the corresponding ID-Number wins a lottery payoff, L, of 72 tokens. Note, however, that according to (3) any lottery winning is deducted from total revenue and, therefore, actual lottery winnings will reduce the amount of the public good, G.

$$\left(\sum_{i=1}^{n} C_i + D + P - L \right) \cdot \frac{\lambda}{n} = G \,, \tag{3}$$

Yet, if there is no audit, there is no lottery and no member of the alpha-group receives the lottery payoff L. This procedure ensures that the lottery payoff, L, is paid to honest taxpayers only. Also, it is worth noting that the subjects in both the alpha- and the beta-group are no longer faced with a decision under risk, where the probability of auditing is known, but with a decision under uncertainty as in the real world. This is because the probability of auditing now depends on how many subjects join the alpha- or beta-group, so that with $n = 5 = n_a + n_b$, ρ-alpha is: $0.5 \cdot (2/n_a)$, and can vary from 0.2 to 0.5 and ρ-beta, which is: $0.5 \cdot (1/n_b)$, and can vary from 0.1 to 0.5.

Third Block: The third block is run in much the same way as in the second block. The only difference with the second block is that the penalty rate is increased from 50 percent of evaded tax to 100 percent of evaded tax, which amounts to a tax rate on undeclared income of $\pi = 0.4$.

Finally, it may be worth noting that apart from differences in parameter values, our design differs in two aspects from that of Alm, Jackson and McKee (1992). First, in our design all subjects receive a fixed and equal income, whereas subject income is variable over a certain range in Alm, Jackson and McKee (1992). Second, in our lottery sessions the probabilities of auditing and lottery winnings are determined endogenously over a certain range, but are fixed in Alm, Jackson and McKee (1992).

4 Strategies

Our theoretical background is in line with Allingham and Sandmo (1972) and Yitzhaki's extension (1974) that introduces a penalty on unpaid taxes in contrast to Allingham and Sandmo's penalty on undeclared income.[3] In particular, we follow Allingham and Sandmo by using their notation and specify a Von-Neumann-Morgenstern utility function of the same kind, but with two differences. First, we use a linear utility function rather than a concave one. Second, following the design described in the preceding section, a public good is provided (see equation (4), third term) that benefits taxpayers and evaders alike. Thus, equation (4) represents the indirect expected utility, *EU*, of the risk neutral representative *i*-th subject in the experiment:

[3] In the experiment we assume a tax rate of $\theta = 0.2$. Now denote by *s* the sanction rate, with s=0.5. Hence, any evader who is audited and detected has to pay: $(\theta W - \theta X_i) + s.(\theta W - \theta X_i) = (\theta + s\theta).(W - X_i)$. Thus, $\pi = (\theta + s\theta) = 0.3$.

$$EU_i = (1-\rho)(W-\theta X_i) + \rho\left[W-\theta X_i - \pi(W-X_i)\right] + \left\{\left(\theta X_i + \theta\sum_{j=1}^{n-1} X_j + \rho\left[\pi(W-X_i) + \pi\sum_{j=1}^{n-1}(W-X_j)\right]\right).\frac{\lambda}{n}\right\} \quad (4)$$

where ρ is the probability that the subject or taxpayer is audited by the institution or tax authorities, W is the exogenously given endowment or income which is known by the subject, but not by the institution, θ is the constant tax rate on declared income, X is the income actually declared by the subject and, as noted above, the subject's actual decision variable, π is the constant tax rate on undeclared income, including: (i) reimbursement of evaded taxes (which corresponds to D in (1)), and (ii) penalty on unpaid taxes (which corresponds to P in (1)), and the index j denotes what the other four subjects in the group may contribute to the public good. The first order derivation of (4) is:

$$\frac{\partial EU_i}{\partial X_i} = -\theta(1-\rho) - \rho\theta + \rho\pi + \left(\frac{\theta-\rho\pi}{n}\right)\lambda \quad (5)$$

Setting (5) equal to zero and rearranging yields:

$$\rho\pi = \theta \ . \quad (6)$$

If condition (6) holds, any rational, expected utility maximizing subject is indifferent between tax compliance and tax evasion, but for, $\rho\pi > \theta$ (6a), it will fully comply with its taxes and for, $\rho\pi < \theta$ (6b), it will fully evade its taxes. Hence, the linear contribution environment of the experiment allows for corner solutions only. Also, despite the provision of a public good, with the given parameter values, rational, expected utility maximizing subjects will continue to fully evade taxes, because they are trapped in a prisoner's dilemma in which the dominant strategy is not to contribute, that is, declare nothing voluntarily with $X_i = 0$. Then, with

parameter values set at $\rho = 0.1$, $\theta = 0.2$, $\pi = 0.3$, $\lambda = 3$, $W = 100$ and $n = 5$, it follows from (4) that the expected payoff in the first block is 106 tokens:

$$EU_i = (0.9)\,(100) + 0.1(70) + [(3 + 12) \cdot 3/5] = 106 \tag{7}$$

where the public good contributions come from expected enforced payments due to audits. In the second and third block, the probability of an audit depends on whether the subject has joined the alpha- or beta-group and on how many other subjects have joined these groups. With $n = 5$ subjects, six alternative subject allocations are conceivable and the expected payoff per subject and round must be calculated for each allocation and each group separately. Table 1 gives an overview with respect to the conceivable allocations in each of the three blocks.

*** Insert Table 1 about here***

Essentially, the expected payoff of a subject in the alpha-group, EU_a, is calculated according to (8a):

$$\begin{aligned} EU_{ai} &= (W - \theta X_{ai}) + (\varphi \cdot \frac{2}{n_a} \cdot \varphi \cdot L) \\ &+ \left[\left(\sum_{i=1}^{na} \theta X_{ai} + \sum_{j=1}^{nb} \theta X_{bj} + \varphi\pi(W - X_{bj})\right) - \varphi L\right] \cdot \frac{\lambda}{n} \end{aligned} \tag{8a}$$

with: $W = X_{ai}\ \forall\ i$, $X_{\mathrm{bj}} = 0\ \ \forall\ j$, and $n_a \geq 2$

where n_a denotes the number of subjects in the alpha-group and φ denotes the probability of either tossing a coin or drawing a card from a stack of two cards, with $\varphi = 0.5$. Note that (8a) is based on the assumption that all subjects in the alpha-group declare their true income, with

$W = X_{ai}$. This assumption can be made because any rational, payoff maximizing subject will join the alpha-group only if it is prepared to declare its true income for otherwise the subject cannot win the lottery and would be faced with a higher probability of an audit compared to the beta-group, as two cards rather than just one card are drawn from the alpha stack. Hence, for simplicity, the first term in (8a) denotes the certain payoff from declaring the true income.

The second term in (8a) denotes the expected payoff from the lottery, where the first φ denotes the probability of an audit due to tossing the coin, the term $2/n_a$ denotes the probability that the *i*-th subject is drawn if two cards from the alpha stack are drawn, and the second φ denotes the probability that the *i*-th subject's ID is drawn from the stack of two cards representing the ID's of the two audited subjects participating in the lottery. Note, however, that (8a) is defined only for $n_a \geq 2$, because for $n_a = 1$ the second term is reduced to just: $\varphi \cdot L$.

Finally, the third term in (8a) denotes the expected payoff from the public good. Within the squared bracket, the first term denotes the sum of voluntary tax payments from the alpha-group (which will be certain), the second term denotes voluntary tax payments from the beta-group (which will be zero), and the third term denotes the expected enforced tax payments (reimbursement and penalty) from the beta-group. The probability of the enforced tax payments is simply that of tossing the coin in the beta-group, because if there is an audit the audited subject will be a tax evader who has declared no income at all, with $X_{bj} = 0$. In fact, it can be assumed that only tax evaders will join the beta-group because any rational, payoff maximizing subject who is prepared to fully declare its true income will join the alpha-group and, for the given parameter values, any rational, payoff maximizing subject in the beta-group will choose to declare no income at all. The fourth term in the square bracket refers to the lottery payment that will be made with the probability of tossing the coin in the alpha-group, because the lottery wining *L* will be paid out whenever there is an audit in the alpha-group.

The expected payoff of a subject in the beta-group is calculated according to (8b):

$$EU_{bi} = (1-\rho_b)(W-\theta X_{bj}) + \rho_b\left[W-\theta X_{bj}-\pi(W-X_{bj})\right] + \left[\left(\sum_{i=1}^{na}\theta X_{ai} + \sum_{j=1}^{nb}\theta X_{bj} + \varphi\pi(W-X_{bj})\right) - \varphi L\right]\cdot\frac{\lambda}{n} \quad (8b)$$

where ρ_b denotes the probability of an audit in the beta-group, with: $\varphi \cdot 1/n_b$, which compares to $\rho_a = \varphi \cdot 2/n_a$ for the alpha-group. For $n_b = 5$ equation (8b) corresponds to (4).

Now consider Table 1 again. For example, the expected payoff of allocation 1, where all five subjects are in the alpha-group (A0B5), is exactly the same as in the first block. Also, in allocation 2, where on subject is in the alpha-group and the remaining four are in the beta-group (A1B4), expected net revenue of the government from the alpha-group members is: (1/2 · 20 + 1/2 · (20–72) =) –16 tokens, and from the beta-group: (1/2 · 0 + 1/2 · 30 =) 15 tokens. Thus, overall expected net revenue is –1 token and, therefore, no public good can be provided in allocation 2 of the second block (see Table 1).

To analyze optimal behavior patterns under the lottery scheme, we first consider the second block, and suppose again that all subjects are in the beta-group (allocation A0B5). Each single subject has an incentive to join the alpha-group, if all others stay in the beta-group, because with an expected payoff of 116 tokens (allocation A1B4) the subject joining the alpha-group would still be better off. Yet, if all others also join the alpha-group each subject would be even better off with an expected payoff of 125.6 tokens (allocation A5B0, Table 1). Hence, if all subjects are in the beta-group (allocation A0B5), each subject has an incentive to join the alpha-group irrespectively of what the others do. Likewise, irrespectively of what the subject under consideration does, all others have an incentive to join the alpha-group (see Table 1). Moreover, if all subjects have joined the alpha-group no subject has an

incentive to rejoin the beta-group or pursue a 'black sheep' strategy[4], because in both cases the expected payoff would be lower than in allocation (A5B0), that is, 120.4 tokens (A4B1) or 124 tokens (A4_1B0) for the 'black sheep' case (see Table 1 and Figure 1). Thus, allocation (A5B0) represents a Pareto-optimal Nash-equilibrium, in which every subject *fully* contributes its taxes.

Regarding this full contribution equilibrium the expected net revenue of the government would be 64 tokens per round and the forgone 36 tokens ($\varphi \cdot L$) due to the lottery should be interpreted as information rent which needs to be paid to subjects or taxpayers in exchange for revealing their private information concerning their taxable income. Hence, for the given parameter constellation, any government that expects total income tax evasion in excess of 36 tokens per round (i.e., on average 7.2 tokens per individual), for the given parameter values, could benefit from the introduction of the lottery scheme. Moreover, regarding a full contribution equilibrium it must be stressed that with the given parameter values, condition (6) indicates that a detection rate in excess of $\rho = 0.66$, or alternatively, a penalty rate in excess of 1,000 percent of evaded tax, i.e. $\pi > 2$, would *c.p.* also establish a full contribution equilibrium. But establishing such a full contribution equilibrium with just one parameter may not be cost efficient. In fact, the costs associated with $\rho > 0.66$ may be too high, or a penalty of more than 1,000 percent on evaded tax, $\pi > 2$, may be so high that it is not enforceable and, therefore, may not represent a real threat. Moreover, individuals may react differently to each parameter variation and, therefore, a revenue maximizing combination of the four instruments

[4] The term *'black sheep' strategy* refers to an allocation in which a tax evader joins the alpha-group. This allocation is denoted as A4_1B0, which means that there are five subjects in the alpha-group, four honest ones and a non-honest one. This may make sense on the grounds that the probability of detection is lower in the alpha-group than in the beta-group. For example, in allocation A4B1 the probability of detection in the beta-group is $\rho = 0.5$, but just 0.2 if the subject joins the alpha-group as a 'black sheep'. Payoffs associated with a 'black sheep' strategy are shown in Table 1 in square brackets. Also, it follows that for tax evaders the probability of auditing, ρ, actually varies only from 0.1 (for B5) to 0.25 (for B2) and is, therefore, not identical with the range of ρ-beta, i.e. 0.1 to 0.5.

'penalty rate', 'detection rate', 'public good' and 'lottery scheme' may exist where each instrument plays its role by assuming a non-zero value.

In the third block of the lottery sessions, as noted, the penalty rate on evaded tax is raised from 50 percent to 100 percent, and the tax rate on undeclared income is, therefore, $\pi = 0.4$. As shown in Table 1, the higher penalty rate increases the incentive of each single subject to join the alpha-group. However, the negative effect of the higher penalty on the expected payoff from full tax evasion is compensated by a higher public good payoff (see Table 1). This effect results from incorporating the revenue of the penalty into the calculation procedure for the public good payoff according to (3). Hence, removing *P* from (3) would help a government to establish a full contribution equilibrium and, because no penalty would be paid once such equilibrium is established, no welfare loss would result from removing *P* from (3).

To summarize, with parameter values specified as described above, rational and utility maximizing individuals would fully evade their taxes in the first block. In the second and third blocks, rational and utility maximizing individuals would now have an incentive to fully pay their taxes. One the one hand, this is due to the introduction of individual lottery winnings for purely honest taxpayers, i.e., the lottery scheme. On the other hand, however, it is worth noting that the full contribution environment also requires the provision of the public good. In particular, this is because the decrease in the expected individual public good payoff (from 38.4 to 30 or 31.2), which is associated with a move of one subject from allocation A5B0 to the 'Black Sheep' strategy (see Table 2, B-type session, second block), is not compensated by the increase in the expected individual payoff (from 87.2 to 94 or 92).

5 Results

Results of a total of nine sessions, with five conducted in Chemnitz/Germany (C1 to C5) and four in Montpellier/France (M1 to M4), are presented in Table 2. All results in Table 2 are denoted in tokens, except '*M/F*' which denotes the number of males and females,

respectively, '*checked*' which denotes the number of audited subjects and '*TC-Ratio*' which refers to the percentage share of full compliances (i.e. 20 tokens given). '*Declared*' refers to the sum of all voluntary contributions, $\sum C_i = \sum \theta X_i$, made by the five acting subjects in the relevant block of six rounds, '*Enforced*' are taxes paid due to an audit, '*P*' are penalties paid due to non-compliance, '*Net Rev.*' refers to net revenue of the government or Total net revenue collected by the government with figures in parenthesis denoting expected net revenue and '*Payoff*' denotes the aggregate payoff of all subjects in a block.

A Wilcoxon-Mann-Whitney rank-sum test (see Table 3) on the items 'Declared', 'TC-Ratio', Net Revenue' and 'Payoff' (section A) and on the relevant differences of these items between rounds (section B), shows that in most cases we cannot reject the null that the figures are drawn from the same population. Exceptions are 'Declared', third block (section A), where we can reject the null at the 10 percent level, 'TC-Ratio', first and third block (section A), where the null is rejected at the 10 percent and 5 percent level, respectively, and 'Net Revenue', third block, where the null is rejected at the 10 percent level. Hence, although there might be some differences regarding the impact of the penalty and full compliance behavior, we conclude that in general there is no significant difference between subject behavior in Chemnitz and Montpellier, so that we can analyze all nine sessions jointly.

Insert Table 2 about here

First Block

With respect to the first block it follows from Table 2, 'Declared', that the actual voluntary contribution or tax compliance level is substantially higher than that calculated for rational, expected utility maximizing subjects in the preceding section, i.e. zero. Yet, the contribution levels are by and large in line with results from linear public goods games in the laboratory or classroom (e.g. see Ledyard 1995, Pickhardt 2005a), where subjects contribute about 40 to 60

percent of their endowment voluntarily. However, the ‘TC-Ratio’ shows that the level of full compliance is substantially lower. Further, the actual number of audits, i.e. 24, is sufficiently close to the expected value of 27. Therefore, net revenue, exceeds voluntary contributions in each case. Note that in contrast to voluntarily declared amounts, net revenue can vary, in principle, from 0 to 660.

Second and third block

First of all it is worth noting that in none of the sessions the theoretically expected full contribution environment (i.e. ‘Declared’ = 600) has emerged, except for session M4, third block. This notwithstanding, a comparison of the ‘Declared’ figures in the second and third block with those in the first block demonstrates that the lottery scheme has a strong and positive influence on tax compliance (see Table 2). A Wilcoxon signed ranks test (see Table 4) shows that we can reject the null of no difference in declared after implementation of the lottery scheme for both the Chemnitz and Montpellier subset at the 10 percent level and for the joint set of sessions at the 1 percent level I have on 5% level declared#3-#2. Hence, we can conclude that voluntary contributions made in both the second and the third blocks are significantly higher than in the first block. In addition, they are also significantly higher in the third block than in the second block.

Essentially the same result holds true if we compare the TC-Ratios. In particular, inspection of Table 4 reveals that in most cases test results for the TC-Ratio allow rejection of the null at a higher level of significance (1%). In comparison with the ‘Declared’ figures this indicates that the lottery scheme not only yields a higher level of tax compliance, but that this increase is predominantly achieved by a much higher rate of full compliance. This further indicates that our scheme of awarding only the purely honest taxpayer does work with respect to tax compliance.

However, although in some cases we do observe that our scheme yields higher net revenues and/or a higher payoff in either the second or third block, Table 4 makes it clear that these results are statically not significant. In fact, in both cases we cannot reject the null of no difference. Therefore, we conclude that the scheme neither increases net revenue for the government nor payoff for the subjects. Yet, at this point it must be emphasized that in sessions C5, M1 and M4 the net revenue of the first block already exceeds the expected revenue of 384 tokens in the second and third block. Therefore, in these sessions the scheme could not have worked. Likewise, in sessions C1, C3, and M2 net revenue of the first block is fairly close to the expected revenue level and, thus, even under extremely favorable circumstances the scheme could have worked only at the margin. In the remaining three sessions C2, C4 and M3 the scheme has worked with respected to net revenue and/or payoff, except where extremely unfavorable odds have prevented that (i.e. session C2, third block).

Gender

To test for possible gender effects we first did a Wilcoxon-Mann-Whitney test on the individual 'Declared' results of all 45 subjects (not displayed here). Regarding the 16 male subjects, we find a *p*-value of 0.34 (Table J, for $W_x = 64$, m = 7, n = 9) and, thus, cannot reject the null. Likewise, with respect to the 29 female subjects, we find a *p*-value of 0.28 (Table A, for $W_x = 208$, m = 13, n = 16). Hence, we can conclude that both males and females show the same behavior pattern in Chemnitz and in Montpellier and that we can, therefore, analyze them jointly. However, regarding males versus females, we find that a *p*-value of 0.0008 (Table A, for $W_x = 234.5$, m = 16, n = 29). Thus, can reject the null at the 1 percent level and conclude that males and females do not show that same behavior pattern. Put differently, regarding a subject's voluntary tax compliance behavior it does not matter whether the subject is French or German, but it does matter whether the subject is male or female.

Moreover, results presented in Table 6 show that the lottery scheme has a positive impact on tax compliance for both female and male taxpayers, but the impact is particularly strong for male taxpayers. Moreover, the figures in Table 6 support the finding of Spicer and Becker (1980, p. 174) that *c.p.* "males evade a greater percentage of their taxes than females".

Finally, it should be stressed that in general the results of the lottery sessions support the findings of Alm, Jackson and McKee (1992) with respect to the influence of positive rewards on honest taxpayers.

6 Policy Recommendations and Concluding Remarks

In this paper we have tested a new experimental design for analyzing the impact of positive rewards on individual tax compliance. Evidence from various sessions suggests that positive rewards in form of individual lottery winnings for purely honest taxpayers have a strong positive impact on tax compliance, as they pull potential tax evaders into the honest taxpayer domain. Also, our results suggest that this positive impact on tax compliance is particularly strong for male taxpayers. Further, our results confirm the findings of others that male taxpayers evade a greater percentage of their taxes than females. Also, it has been demonstrated in section four that the lottery scheme implies some costs (i.e. an information rent) and can therefore be revenue enhancing only if the actual net revenue is below a certain threshold (i.e. 384 tokens, see Table 2).

Taken together, these findings imply that the introduction of individual lottery winnings for purely honest taxpayers will be rather successful in terms of an overall revenue increase in economies with a low rate of tax compliance and a high share of male taxpayers. As such circumstances may predominantly prevail in developing countries, introducing individual lottery winnings for honest taxpayers seems to be a much rewarding tax policy for developing countries.

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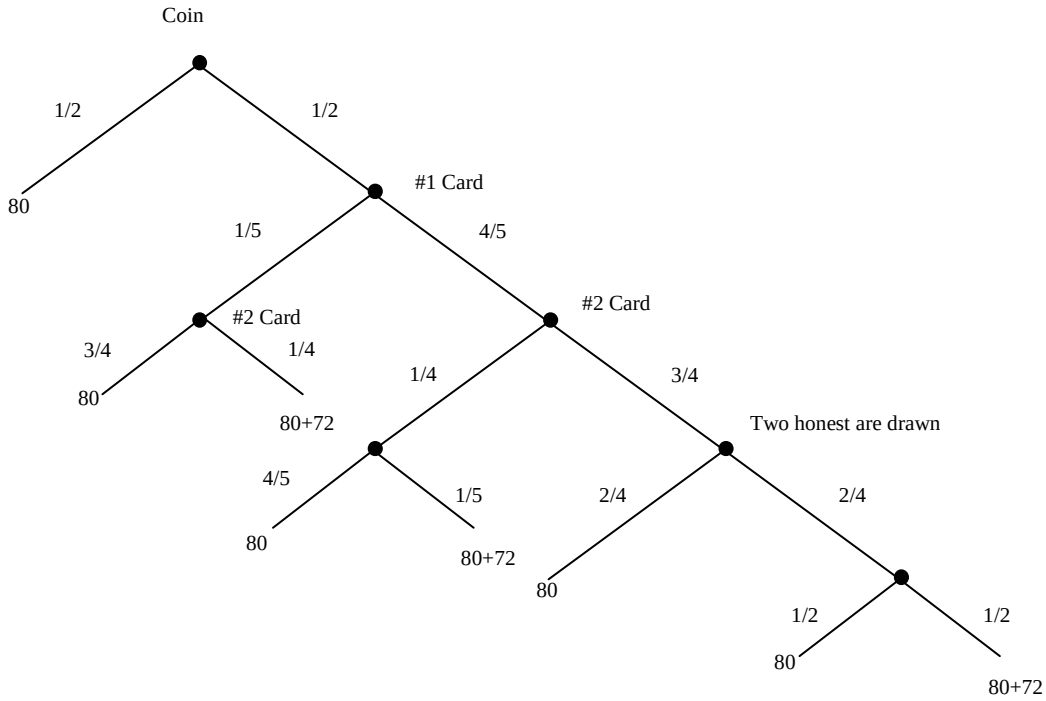
Figure 1: Probability and Payoff Calculation 'Black Sheep' Strategy, #2 Block

Probability A4_1



Expected Payoff A4_1 **(i.e. for an Honest Taxpayer)**

$$\frac{1}{2}\cdot 80+\frac{1}{2}\cdot\frac{1}{5}\cdot\frac{3}{4}\cdot 80+\frac{1}{2}\cdot\frac{1}{5}\cdot\frac{1}{4}\cdot 152+\frac{1}{2}\cdot\frac{4}{5}\cdot\frac{1}{4}\cdot\frac{4}{5}\cdot 80+\frac{1}{2}\cdot\frac{4}{5}\cdot\frac{1}{4}\cdot\frac{1}{5}\cdot 152+\frac{1}{2}\cdot\frac{4}{5}\cdot\frac{3}{4}\cdot\frac{2}{4}\cdot 80$$
$$+\frac{1}{2}\cdot\frac{4}{5}\cdot\frac{3}{4}\cdot\frac{2}{4}\cdot\frac{1}{2}\cdot 80+\frac{1}{2}\cdot\frac{4}{5}\cdot\frac{3}{4}\cdot\frac{2}{4}\cdot\frac{1}{2}\cdot 152=0.88\cdot 80+0.12\cdot 152=88.64$$

Expected Payoff A4**_1 (i.e. for the Black Sheep)**

$$\frac{1}{2}\cdot 100+\frac{1}{2}\cdot\frac{1}{5}\cdot 70+\frac{1}{2}\cdot\frac{4}{5}\cdot\frac{1}{4}\cdot 70+\frac{1}{2}\cdot\frac{4}{5}\cdot\frac{3}{4}\cdot\frac{4}{5}\cdot 100=0.8\cdot 100+0.2\cdot 70=94$$

Expected Public Good Payoff

$$\left[\frac{1}{2}\cdot 80+\frac{1}{2}\cdot\frac{4}{5}\cdot\frac{3}{4}\cdot(80-72)+\frac{1}{2}\cdot\frac{1}{5}\cdot 1\cdot(80+30-72)+\frac{1}{2}\cdot\frac{4}{5}\cdot\frac{1}{4}\cdot(80+30-72)\right]\cdot\frac{3}{5}=30$$

Table 1: Expected Payoffs (in tokens)

#1 Block
all subjects
(97+9) = **106**

#2 Block	
per "Alpha"-subject	per "Beta"-subject
A0= –	B5= (97+9)=**106**
A1= (116+0)=**116**	B4= (96.25+0)=**96.25**
A2= (98+11.4)=**109.4**	B3= (95+11.4)=**106.4**
A3= (92+23.4)=**115.4**	B2= (92.5+23.4)=**115.9**
A4= (89+35.4)=**124.4** [A4= (88.64+30)=**118.64**]	B1= (85+35.4)=**120.4** [A_1= (94+30)=**124**]
A5=(87.2+38.4)= **125.6**	B0= **–**

#3 Block	
per "Alpha"-subject	per "Beta"-subject
A0= –	B5= (96+12)=**108**
A1= (116+2.4)=**118.4**	B4= (95+2.4)=**97.4**
A2= (98+14.4)=**112.4**	B3= (93.3+14.4)=**107.7**
A3= (92+26.4)=**118.4**	B2= (90+26.4)=**116.4**
A4= (89+38.4)=**127.4** [A4= (88.64+31.2)=**119.84**]	B1= (80+38.4)=**118.4** [A_1= (92+31.2)=**123.2**]
A5= (87.2+38.4)=**125.6**	B0= **–**

Notes: Expected payoffs in the second blocks, allocation A0B5, correspond to the results of equations (13). For all other allocations, the expected payoffs depend on the probability of auditing and, on the expected net revenue that is paid back as a public good. The first figure in round brackets represents the expected payoff from full tax compliance (alpha-group) or full tax evasion (beta-group), whereas the second figure in round brackets represents the public good payoff. In the second block, allocation A1B4, the public good payoff is 0 because the expected net revenue of the government is negative, so that no public good can be provided. Square brackets denote payoffs from a 'black sheep' strategy, where A_1 denotes the 'black sheep'.

Table 2: Results per Block and Session for Chemnitz and Montpellier (in tokens)

	Chemnitz					Montpellier				Average		
	C1	C2	C3	C4	C5	M1	M2	M3	M4	CA	MA	TA
(M/F)	(2/3)	(2/3)	(2/3)	(3/2)	(0/5)	(2/3)	(1/4)	(3/2)	(1/4)	(9/16)	(7/13)	(16/29)
#1 Block												
Declared	349	241	337	252	458	396	295	277	424	327	348	337
TC-Ratio	0/30	4/30	3/30	1/30	4/30	11/30	7/30	1/30	15/30	2/30	9/30	5/30
Enforced	18	20	19	60	10	39	54	21	20	26	34	30
(Checked)	(2)	(2)	(2)	(4)	(2)	(4)	(4)	(2)	(2)			
P (50%)	9	10	9.5	30	5	19.5	27	10.5	10	13	17	15
Net Rev.	*376*	*271*	*365.5*	*342*	*473*	*455*	*376*	*308.5*	*454*	*366*	*398*	*382*
	(90)	*(90)*	*(90)*	*(90)*	*(90)*	*(90)*	*(90)*	*(90)*	*(90)*	*(90)*	*(90)*	*(90)*
Payoff	*3706*	*3542*	*3729*	*3580*	*3941*	*3949*	*3682*	*3617*	*3940*	*3700*	*3797*	*3743*
#2 Block												
Declared	410	532	495	420	374	440	469	404	587	446	475	461
TC-Ratio	10/30	25/30	23/30	15/30	16/30	22/30	21/30	19/30	28/30	18/30	23/30	20/30
Enforced	44	3	0	20	60	0	20	40	0	25	15	20
(Checked)	(α=5; β=5)	(α=4; β=1)	(α=6; β=2)	(α=4; β=1)	(α=5; β=3)	(α=2; β=1)	(α=2; β=2)	(α=6; β=2)	(α=4; β=1)			
P (50%)	22	1.5	0	10	30	0	10	20	0	13	8	10
(-)Lottery	72	144	216	144	216	72	144	216	144	187	144	166
Net Rev.	*404*	*392.5*	*279*	*306*	*248*	*368*	*354*	*248*	*443*	*297*	*353*	*325*
	(384)	*(384)*	*(384)*	*(384)*	*(384)*	*(384)*	*(384)*	*(384)*	*(384)*	*(384)*	*(384)*	*(384)*
Payoff	*3535*	*3791*	*3629*	*3611*	*3518*	*3706*	*3758*	*3586*	*3884*	*3617*	*3734*	*3669*
#3 Block												
Declared	491	482	500	476	528	505	492	580	600	495	544	519
TC-Ratio	20/30	23/30	24/30	19/30	22/30	24/30	24/30	29/30	30/30	19/30	27/30	24/30
Enforced	41	0	0	46	1	40	18	0	0	18	7	13
(Checked)	(α=4; β=3)	(α=12 ; β=1)	(α=8; β=0)	(α=7; β=4)	(α=6; β=1)	(α=8; β=2)	(α=6; β=1)	(α=4; β=0)	(α=4; β=0)			
P (100%)	41	0	0	46	1	40	18	0	0	18	7	13
(-)Lottery	144	432	288	288	216	288	216	144	144	274	198	236
Net Rev.	*429*	*50*	*212*	*280*	*314*	*297*	*312*	*436*	*456*	*257*	*360*	*309*
	(384)	*(384)*	*(384)*	*(384)*	*(384)*	*(384)*	*(384)*	*(384)*	*(384)*	*(384)*	*(384)*	*(384)*
Payoff	*3878*	*3096*	*3430*	*3608*	*3628*	*3624*	*3624*	*3872*	*3912*	3528	3758	3630

Notes: 'M/F' refers to the number of male/female subjects, 'Declared' denotes total voluntary contributions (max. 600), 'TC-Ratio' denotes total compliance ratio, which is measured as the number of full compliances (frequency of 20) over the total number of tax payments per block (i.e. 5·6=30), 'Enforced' denotes contributions enforced due to an audit, 'Checked' denotes the number of checked or audited subjects, 'P' denotes penalty payments due to an audit, 'Lottery' denotes lottery winnings, and 'Net Rev.' denotes the net income of the government (declared+enforced+penalty[-lottery]) and figures in parentheses denote expected net revenue per block according to section four (for example, first block all sessions, 90 is calculated from: 100-97=3, 3·5·6=90), 'Payoff' denotes total payoff per block.

Table 3: Wilcoxon-Mann-Witney rank-sum test

Session	C1	C2	C3	C4	C5	*M1*	*M2*	*M3*	*M4*	**RSM**	***p***
A											
#1 Dec	349	241	337	252	458	*396*	*295*	*277*	*424*	-	
Rank	6	1	5	2	9	*7*	*4*	*3*	*8*	*22*	*0.3651*
#2 Dec	410	532	495	420	374	*440*	*469*	*404*	*587*	-	
Rank	3	8	7	4	1	*5*	*6*	*2*	*9*	*22*	*0.3651*
#3 Dec	491	482	500	476	528	*505*	*492*	*580*	*600*	-	
Rank	3	2	5	1	7	*6*	*4*	*8*	*9*	*27*	*0.0556*
#1 TC	0	4	3	1	4	*11*	*7*	*1*	*15*	-	
Rank	1	5.5	4	2.5	5.5	*8*	*7*	*2.5*	*9*	*26.5*	*0.0556*
#2 TC	10	25	23	15	16	*22*	*21*	*19*	*28*	-	
Rank	1	8	7	2	3	*6*	*5*	*4*	*9*	*23*	*0.2778*
#3 TC	20	23	24	19	22	*24*	*24*	*29*	*30*	-	
Rank	2	4	6	1	3	*6*	*6*	*8*	*9*	*29*	*0.0159*
#1 Net	376	271	366	342	473	*455*	*376*	*309*	*454*	-	
Rank	5.5	1	4	3	9	*8*	*5.5*	*2*	*7*	*22.5*	*0.2778*
#2 Net	404	393	279	306	248	*368*	*354*	*248*	*443*	-	
Rank	8	7	3	4	1.5	*6*	*5*	*1.5*	*9*	*21.5*	*0.3651*
#3 Net	429	50	212	280	314	*297*	*312*	*436*	*456*	-	
Rank	7	1	2	3	6	*4*	*5*	*8*	*9*	*26*	*0.0952*
#1 Pay	3706	3542	3729	3580	3941	*3949*	*3682*	*3617*	*3940*	-	
Rank	5	1	6	2	8	*9*	*4*	*3*	*7*	*23*	*0.2778*
#2 Pay	3535	3791	3629	3611	3518	*3706*	*3758*	*3586*	*3884*	-	
Rank	2	8	5	4	1	*6*	*7*	*3*	*9*	*25*	*0.1429*
#3 Pay	3878	3096	3430	3608	3628	*3624*	*3624*	*3872*	*3912*	-	
Rank	8	1	2	3	6	*4.5*	*4.5*	*7*	*9*	*25*	*0.1429*
B											
#2-#1 Dec	61	291	158	168	-84	*44*	*174*	*127*	*163*	-	
Rank	3	9	5	7	1	*2*	*8*	*4*	*6*	*20*	*0.5476*
#3-#2 Dec	81	-50	5	56	154	*65*	*23*	*176*	*13*	-	
Rank	7	1	2	5	8	*6*	*4*	*9*	*3*	*22*	*0.3651*
#3-#1 Dec	142	241	163	224	70	*109*	*197*	*303*	*176*	-	
Rank	3	8	4	7	1	*2*	*6*	*9*	*5*	*22*	*0.3651*
#2-#1 TC	10	21	20	14	12	*11*	*14*	*18*	*13*	-	
Rank	1	9	8	5.5	3	*2*	*5.5*	*7*	*4*	*18.5*	*0.6349*
#3-#2 TC	10	-2	1	4	6	*2*	*3*	*10*	*2*	-	
Rank	8.5	1	2	6	7	*3.5*	*5*	*8.5*	*3.5*	*20.5*	*0.4524*
#3-#1 TC	20	19	21	18	18	*13*	*17*	*28*	*15*	-	
Rank	7	6	8	4.5	4.5	*1*	*3*	*9*	*2*	*15*	*0.9048*

#2-#1 Net	-116	122	-87	-39	-225	*-87*	*-22*	*-61*	*-11*	-	
Rank	2	9	3.5	6	1	*3.5*	*7*	*5*	*8*	*23.5*	*0.2036*
#3-#2 Net	109	-343	-67	-26	66	*-131*	*-42*	*188*	*13*	-	
Rank	8	1	3	5	7	*2*	*4*	*9*	*6*	*21*	*0.4524*
#3-#1 Net	53	-221	-154	-65	-159	*-218*	*-64*	*128*	*2*	-	
Rank	8	1	4	5	3	*2*	*6*	*9*	*7*	*24*	*0.2063*
#2-#1 Pay	-171	249	-100	31	-423	*-243*	*76*	*-31*	*-56*	-	
Rank	3	9	4	7	1	*2*	*8*	*6*	*5*	*21*	*0.4524*
#3-#2 Pay	343	-695	-199	-3	110	*-82*	*-134*	*286*	*28*	-	
Rank	9	1	2	5	7	*4*	*3*	*8*	*6*	*21*	*0.4524*
#3-#1 Pay	172	-446	-299	28	-313	*-325*	*-58*	*255*	*-28*	-	
Rank	8	1	4	7	3	*2*	*5*	*9*	*6*	*22*	*0.3651*

Notes: A denotes a comparison of absolute values; B denotes a comparison of differences;'#1, #2 and #3 Dec' denotes total voluntary contributions; TC denotes total compliance ratio, where for simplicity just the nominator values are considered; Net denotes Net Revenue and Pay denotes Payoff (see Table 2); #2-#1, #3-#2, and #3-#1 denote the difference of the relevant values in the two blocks under consideration with respect to Dec, TC, Net and Pay; ranks compare to those in Table 5, except where negative values are involved; p-values are taken from Siegel and Castellan (1985, p. 340).

Table 4: Wilcoxon signed ranks test on Declared and TC-Ratio

Session	C1	C2	C3	C4	C5	*M1*	*M2*	*M3*	*M4*	PRS	p-value
Declared											
(#2 - #1)	61	291	158	168	-84	*44*	*174*	*127*	*163*	C *M*	
Rank	1	5	3	4	(2)	*1*	*4*	*2*	*3*	13 *10*	*0.0938 / 0.0625*
Rank	2	9	5	7	(3)	*1*	*8*	*4*	*6*	42	0.0098
(#3 - #2)	81	-50	5	56	154	*65*	*23*	*176*	*13*	C *M*	
Rank	4	(2)	1	3	5	*3*	*2*	*4*	*1*	13 *10*	*0.0938 / 0.0625*
Rank	7	(4)	1	5	8	*6*	*3*	*9*	*2*	41	0.0137
(#3 - #1)	142	241	163	224	70	*109*	*197*	*303*	*176*	C *M*	
Rank	2	5	3	4	1	*1*	*3*	*4*	*2*	15 *10*	*0.0313 / 0.0625*
Rank	3	8	4	7	1	*2*	*6*	*9*	*5*	45	0.0020
TC-Ratio											
(#2 - #1)	10	21	20	14	12	*11*	*14*	*18*	*13*	C *M*	
Rank	1	5	4	3	2	*1*	*3*	*4*	*2*	15 10	*0.0313 / 0.0625*
Rank	1	9	8	5.5	3	*2*	*5.5*	*7*	*4*	45	0.0020
(#3 - #2)	10	-2	1	4	6	*2*	*3*	*10*	*2*	C *M*	
Rank	5	(2)	1	3	4	*1.5*	*3*	*4*	*1.5*	13 10	*0.0938 / 0.0625*
Rank	8.5	(3)	1	6	7	*3*	*5*	*8.5*	*3*	42	0.0098
(#3 - #1)	20	19	21	18	18	*13*	*17*	*28*	*15*	C *M*	
Rank	4	3	5	1.5	1.5	*1*	*3*	*4*	*2*	15 10	*0.0313 / 0.0625*
Rank	7	6	8	4.5	4.5	*1*	*3*	*9*	*2*	45	0.0020

Notes: #2-#1, #3-#2, and #3-#1 denote the difference of the relevant values in the two blocks under consideration, parenthesis denote negative ranks, PRS denotes the sum of the positive ranks and p-values are taken from Siegel and Castellan (1985, p. 332).

Table 5: Wilcoxon signed ranks test on Net-Revenue and Payoff

Session	C1	C2	C3	C4	C5	*M1*	*M2*	*M3*	*M4*	PRS	p-value
Net-Rev.											
(#2 - #1)	28	122	-87	-36	-225	*-87*	*-22*	*-61*	*-11*	C *M*	
Rank	1	4	(3)	(2)	(5)	*(4)*	*(2)*	*(3)*	*(1)*	5 *0*	*>0.5 / >0.5*
Rank	3	8	(6.5)	(4)	(9)	*(6.5)*	*(2)*	*(5)*	*(1)*	11	>0.5
(#3 - #2)	25	-343	-67	-26	66	*-71*	*-42*	*188*	*13*	C *M*	
Rank	1	(5)	(4)	(2)	3	*(3)*	*(2)*	*4*	*1*	4 *5*	*>0.5 / >0.5*
Rank	2	(9)	(6)	(3)	5	*(7)*	*(4)*	*8*	*1*	16	>0.5
(#3 - #1)	53	-221	-154	-62	-159	*-158*	*-64*	*128*	*2*	C *M*	
Rank	1	(5)	(3)	(2)	(4)	*(4)*	*(2)*	*3*	*1*	1 *4*	*>0.5 / >0.5*
Rank	2	(9)	(6)	(3)	(8)	*(7)*	*(4)*	*5*	*1*	8	>0.5
Payoff											
(#2 - #1)	-171	249	-100	31	-423	*-243*	*76*	*-31*	*-56*	C *M*	
Rank	(3)	4	(2)	1	(5)	*(4)*	*3*	*(1)*	*(2)*	5 3	*>0.5 / >0.5*
Rank	(6)	8	(4)	1.5	(9)	*(7)*	*4*	*(1.5)*	*(3)*	13.5	>0.5
(#3 - #2)	343	-695	-199	-3	110	*-82*	*-134*	*286*	*28*	C *M*	
Rank	4	(5)	(3)	(1)	2	*(1)*	*(3)*	*4*	*1*	6 5	*>0.5 / >0.5*
Rank	8	(9)	(6)	(1)	4	*(3)*	*(5)*	*7*	*2*	21	>0.5
(#3 - #1)	172	-446	-299	28	-313	*-325*	*-58*	*255*	*-28*	C *M*	
Rank	2	(5)	(3)	1	(4)	*(4)*	*(2)*	*3*	*(1)*	3 3	*>0.5 / >0.5*
Rank	4	(9)	(6)	1.5	(7)	*(8)*	*(3)*	*5*	*(1.5)*	10.5	>0.5

Notes: #2-#1, #3-#2, and #3-#1 denote the difference of the relevant values in the two blocks under consideration, parenthesis denote negative ranks, PRS denotes the sum of the positive ranks and p-values are taken from Siegel and Castellan (1985, p. 332).

Table 6: Gender Specific Results per Block and Session for Chemnitz and Montpellier

	Chemnitz					Montpellier				Average		
	C1	**C2**	**C3**	**C4**	**C5**	**M1**	**M2**	**M3**	**M4**	**CA**	**MA**	**TA**
(M/F)	(2/3)	(2/3)	(2/3)	(3/2)	(-/5)	(2/3)	(1/4)	(3/2)	(1/4)	(9/16)	(7/13)	(16/29)
#1 Block Males	2	2	2	3	-	2	1	3	1	9	7	16
Declared	67	15	59	29	-	50	33	64	20	41	49	44
TC-Ratio	0/12	0/12	1/12	1/18	-	0/12	0/6	1/18	1/6	-	-	-
Enforced (Checked)	8	10	14	60	-	24	10	1	20	-	-	-
P (50%)	4	5	7	30	-	12	5	0.5	10	-	-	-
Net Rev.	*145*	*45*	*139*	*176*	-	*135*	*48*	*192.5*	*50*	*56*	*61*	*58*
Payoff	*1,491*	*1,480*	*1,504*	*2,245*	-	*1,620*	*772*	*2,163*	*822*	*747*	*768*	*756*
#1 Block Females	3	3	3	2	5	3	4	2	4	16	13	29
Declared	72	70	73	83	92	99	66	43	101	79	81	80
TC-Ratio	0/18	4/18	2/18	0/12	4/30	11/18	7/24	0/12	14/24	-	-	-
Enforced (Checked)	10	10	5	0	10	15	44	20	0	-	-	-
P (50%)	5	5	2.5	0	5	7.5	22	10	0	-	-	-
Net Rev.	*231*	*226*	*227*	*166*	*473*	*320*	*328*	*116*	*404*	*83*	*90*	*86*
Payoff	*2,220*	*2,062*	*2,225*	*1,445*	*3,941*	*2,299*	*2,910*	*1,454*	*3,118*	*743*	*752*	*747*
#2 Block Males	2	2	2	3	-	2	1	3	1	9	7	16
Declared	82	120	95	70	-	40	90	85	120	89	78	84
TC-Ratio	5/12	12/12	9/12	10/18	-	4/12	3/6	12/18	6/6	-	-	-
Enforced (Checked)	8	0	0	20	-	0	10	20	0	-	-	-
P (100%)	4	0	0	10	-	0	5	10	0	-	-	-
(-)Lottery	-	-	-	144	-	-	-	144	72	-	-	-
Net Rev.	*175*	*240*	*190*	*96*	-	*80*	*105*	*140*	*48*	*78*	*53*	*67*
Payoff	*1,487*	*1,431*	*1,367*	*2,250*	-	*1,550*	*718*	*2,160*	*816*	726	749	736
#2 Block Females	3	3	3	2	5	3	4	2	4	16	13	29
Declared	82	97	102	105	75	120	95	75	117	89	104	96
TC-Ratio	5/18	13/18	14/18	5/12	16/30	18/18	18/24	7/12	22/24	-	-	-
Enforced (Checked)	36	3	0	0	60	0	10	20	0	-	-	-
P (100%)	18	1.5	0	0	30	0	5	10	0	-	-	-
(-)Lottery	72	144	216	-	216	72	144	72	72	-	-	-
Net Rev.	*229*	*153*	*89*	*210*	*248*	*288*	*364*	*108*	*395*	*58*	*89*	*72*
Payoff	*2,048*	*2,360*	*2,262*	*1,361*	*3,518*	*2,156*	*3,040*	*1,426*	*3,068*	*722*	*745*	*732*

#3 Block Males	2	2	2	3	-	2	1	3	1	9	7	16
Declared	86	105	80	83	-	80	120	113	120	88	106	96
TC-Ratio	6/12	10/12	8/12	11/18	-	8/12	6/6	17/18	6/6	-	-	-
Enforced (Checked)	15	0	0	40	-	40	0	0	0	-	-	-
P (100%)	15	0	0	40	-	40	0	0	0	-	-	-
(-)Lottery	-	216	144	72	-	72	-	144	-	-	-	-
Net Rev.	*201*	*-6*	*16*	*258*	-	*168*	*120*	*196*	*120*	*52*	*86*	*67*
Payoff	*1,504*	*1266*	*1441*	*2075*	-	*1,412*	*667*	*2,389*	*754*	*698*	*746*	*719*

#3 Block Females	3	3	3	2	5	3	4	2	4	16	13	29
Declared	107	91	113	113	106	115	93	120	120	106	111	108
TC-Ratio	14/18	13/18	16/18	8/12	22/30	16/18	18/24	12/12	24/24	-	-	-
Enforced (Checked)	26	0	0	6	1	0	18	0	0	-	-	-
P (100%)	26	0	0	6	1	0	18	0	0	-	-	-
(-)Lottery	144	216	144	216	216	216	216	-	144	-	-	-
Net Rev.	*230*	*56*	*196*	*10*	*314*	*129*	*192*	*240*	*336*	*50*	*69*	*59*
Payoff	*2,324*	*1,830*	*1,989*	*1,533*	*3,628*	*2,212*	*2,957*	*1,483*	*3,158*	*707*	*755*	*728*

Notes: 'M/F' refers to the number of male and female subjects, 'Declared' denotes voluntary contributions per capita and block of 6 rounds for either males or females, multiplying these figures with the number of males and females, respectively, and adding the values for males and females gives the corresponding values in Table 2, 'TC-Ratio' denotes total compliance ratio, which is measured as the number of full compliances (20) over the total number of tax payments per block for males and females, 'Enforced' denotes contributions enforced due to an audit, 'Checked' denotes the number of checked or audited subjects, 'Penalty' denotes penalty payments due to an audit, 'Lottery' denotes lottery winnings, and 'Net Rev.' denotes the net income of the government per block from either males or females, adding of the male and female figures gives the corresponding value in Table 2,'Payoff' denotes payoff per block for males and females, again adding yields relevant figures in Table 2.

Documents de Recherche parus en 2009[1]

DR n°2009 - 01_ : Cécile BAZART and Michael PICKHARDT
« Fighting Income Tax Evasion with Positive Rewards: Experimental Evidence »

[1] La liste intégrale des Documents de Travail du LAMETA parus depuis 1997 est disponible sur le site internet : http://www.lameta.univ-montp1.fr

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