L A M E T A
Laboratoire Montpelliérain
d'Economie Théorique et Appliquée
U M R
Unité Mixte de Recherche

DOCUMENT de RECHERCHE

« Whistleblowing vs random audit:

An experimental test of relative

efficiency »

Cécile BAZART
Mickael BEAUD
Dimitri DUBOIS

DR n°2017-04

Unite de Formation et de Recherche d'Economie
Avenue Raymond DUGRAND C.S. 79606
3 4 9 6 0 MONTPELLIER Cedex 2

E-mail : lameta@lameta.univ-montp1.fr
web : www.lameta.univ-montp1.fr

Whistleblowing vs random audit : An experimental test of relative efficiency[☆]

Cécile Bazart*, Mickael Beaud, Dimitri Dubois

LAMETA, Université de Montpellier, CNRS, INRA, SupAgro, Université Paul Valery
Faculté d'Economie, Avenue Raymond Dugrand, CS 59640, 34960 Montpellier cedex 2, France

Abstract

This paper reports an experimental test of the relative efficiency of a whistleblowing-based audit scheme compared to a random-based audit scheme. We design a between-subjects laboratory experiment with two treatments: a benchmark with a random-based audit scheme and an alternative treatment in which taxpayers can blow the whistle. Compared to the benchmark, the whistleblowing-based audit scheme (i) decreases the monetary amount of tax evasion, (ii) improves the targeting of evaders and (iii) raises the tax levy.

Key words: Tax evasion, tax compliance, deterrence, detection, audit policy, denouncement, laboratory experiments.

1. Introduction

The tax evasion problem has initially been modeled by Allingham & Sandmo (1972) as a portfolio choice where taxpayers decide of the share of real income they report by comparing expected costs to expected benefits. Following this seminal work, substantial research efforts have been devoted to the study of deterrent policies, from the impact of the probability of detection, to the severity of punishment upon detection. Moreover, information being at the heart of this principal-agent relationship, as taxpayers have their real income as private information, several types of signals have been studied in the literature: past evasion history (Landsberger & Meilijson 1982, Greenberg 1984), declaration choices (Reinganuum & Wilde 1988, Cremer et al. 1990, Beck & Jung 1989, Sanchez & Sobel 1993, Erard & Feinstein 1994, Rhoades 1999), and conspicuous consumption (Yaniv 2013).

So far, little attention has been paid to whistleblowing-based audit schemes (thereafter WBAS) that could, however, be a useful source of information for tax administrations. Indeed, WBAS provides private information that is otherwise difficult and costly to collect and therefore allows to

[☆]We are grateful to the participants of the shadow annual conference (2013, Munster), the International Tax Analysis conference (2014, London), the TARC workshop (2015, UK) and the LAMETA-LEEM workgroup for helpful comments and discussions. We also thank the University of Montpellier for funding (BUSR 2014).

*Corresponding author.

Email addresses: cecile.bazart@umontpellier.fr (Cécile Bazart), mickael.beaud@umontpellier.fr (Mickael Beaud), dimitri.dubois@umontpellier.fr (Dimitri Dubois)

target audits more accurately on misreporting taxpayers. Whistleblowing is a widespread practice showing quick developments in recent time. For instance, the american IRS has created an official "whistleblower office" in 2006 with the objective of increasing tax revenue by using private information provided by whistleblowers. In line with this, the present paper adresses the question of the relative efficiency of a WBAS compared to a standard random-based audit scheme (thereafter RBAS). Traditionally audits efficiency is analyzed by considering their direct and indirect effects on tax revenue. The direct effect refers to the impact on tax revenue of the degree of accuracy of the audit scheme (net of its operating cost). In particular, more "*big fish*" cases within the audited population of taxpayers would result in higher reimbursement of evaded taxes and higher payment of resulting fines (if proportional to the amount evaded). The indirect effect corresponds to a self-compliance effect implying that the behavior of *all* taxpayers is affected by the characteristics of the audit scheme. Indeed, the more taxpayers perceive the audit scheme as dissuasive the less they would evade. Therefore, at constant operating cost, a better targeted and/or a more dissuasive audit scheme would have an unambiguous positive impact on tax revenue.

In the theoretical literature on tax evasion and audit design, only few contributions consider the possibility of whistleblowing. To the best of our knowledge, Yaniv (2001) has been the first to model and to incorporate an informing decision, precisely the possibility for individuals to inform the tax administration about evaders, in the optimization problem faced by the tax administration of selecting optimal prosecution efforts and rewards for informants. More recently, Mealem et al. (2010) compare reporting decisions facing a one-round random audit or a two-round whistleblowing-based audit. In the latter, taxpayers are invited to denounce evaders who have escaped a random audit in the first round and only the denounced taxpayers are randomly audited in the second-round. Mealem et al. (2010) point out that the tax administration would clearly perform better using a whistleblowing-based audit if and only if whistleblowers are honest, that is, if and only if they denounce real evaders. On the contrary, if evaders are able to reduce their own audit probability through false denunciations and do so (strategic whistleblowers), the two schemes might become equivalent. In addition, if honest whistleblowers find no sufficient incentives to denounce real evaders, then the whistleblowing-based audit might even become less efficient.

To the best of our knowledge, there is only one experimental study by Masclet et al. (2013) introducing whistleblowing in the context of tax evasion. They investigate the impact on tax evasion of providing information to taxpayers on the use of tax revenue (credit carbon purchase) in three different dynamic contexts: (i) a baseline treatment with a cut off rule associated with a retroactive audit, (ii) an information treatment which only differs from the baseline treatment by providing the income declaration rates of all other group members, (iii) a denunciation treatment identical to the information treatment in which each one has the opportunity to blow the whistle and where each denounced taxpayers is audited, meaning that the tax administration faces no budget constraint. Hence, by comparing (ii) and (iii) they observed that allowing for whistleblowing opportunities

reduces tax evasion.

By constrast with existing litterature, the present paper focuses on the question of the efficiency of an audit scheme based on whistleblowing. As a starting point, we find necessary to put aside any particular incentive to denounce (e.g. rewards, denunciation costs, revenge), and to guarantee that operating costs are kept constant (i.e. independent of the audit scheme implemented). Moreover, for clarity sake, we chose to compare the WBAS to a benchmark RBAS. In our whistleblowing-based audit scheme, each taxpayer's probability of being audited is determined by his relative whistleblowing score. We show that under the WBAS, compared to under the RBAS, (i) the monetary amount of tax evasion decreases, (ii) the targeting of evaders is improved and (iii) the tax levy raises.

The remaining of the paper is organized as follows. Section 2 details the experimental procedure and design and section 3 exposes the corresponding theoretical framework and predictions. Results of the experiment are presented in section 4 and we conclude in section 5.

2. Experimental procedure and design

The experiment was run in the experimental lab of Montpellier (LAMETA-LEEM, France). Participants were recruited from a pool of 4000 volunteer students from various fields of study of the University.[1] Upon arrival at the laboratory, participants seated in front of a computer terminal and were asked to silently and individually read the instructions. Once all the participants had finished, an experimenter read the instructions aloud. Participants then filled in a computerized questionnaire in order to check their understanding of the instructions.[2] Participants were informed they could raise their hand at any moment to ask for additional private explanations.

The experiment consists of an income reporting game under two audit treatments: one with a RBAS and one with a WBAS. The two treatments were conducted in an identical manner with two independent successive parts. At the beginning of the experiment participants were told that they were going to receive instructions for part 2 at the end of part 1, and that their final payoff for the experiment would be the cumulative payoff of the two parts. In part 1 subjects participated to a simple real-money portfolio choice aiming at capturing their sensitivity to risky decisions.[3] More precisely participants had an initial endowment of 10 euros and had to decide its allocation between a safe asset with return rate normalized to unity and an actuarially favorable risky asset with rate of return $\tilde{k} = (0, 1/2; 3, 1/2)$, i.e. with probability one half they lose the amount invested and with probability one half they get back three times their investment. Without any information about the result of part 1, subjects then participated in part 2, that is a repeated income reporting

[1] For the management of the subject pool the LEEM uses ORSEE (Online Recruitment Software for Economic Experiment, Greiner (2004)).

[2] The program for the experiment has been developed using LE2M (Software for the Economic Experiments of Montpellier, D. Dubois).

[3] We applied the same portfolio choice and procedure than in Beaud & Willinger (2015).

game.[4] We ran two sessions of 20 subjects for each treatment leading therefore to a total of 80 participants in the experiment.

At the beginning of the income reporting game, groups of five players were randomly formed and kept unchanged for the whole repetitions. We thus collected eight independent data (groups) for each treatment. The game consists in 20 repetitions, with each repetition including 3 steps. In step 1, players are endowed with an income of 100 ecus[5] and must decide how much of their income to report. In step 2 they are informed about the amount of their tax (20% of the reported income) and about the reported income of each of the four other members of their group, identified by a letter, B, C, D, or E kept unchanged for the whole game. In the whistleblowing treatment, the only difference is that at that stage players are asked whether they want or not to denounce all, any or none of their group members. To this purpose additional lines are displayed on the screen with the labels[6] "Do you want to denounce member B/C/D/E?" and two radio buttons "Yes" and "No" are displayed and record the answer given in a click. As a consequence each subject can be denounced zero, one, two, three or four times. Finally in step 3 players are individually informed whether or not they have been audited. In case of prosecution subjects have to reimburse the amount of tax evaded and, in addition, have to pay a fine rate equal to 150% of this amount (leading to a penalty rate of 250%). Last, the summary of the period is displayed. Some important points here are that players are not informed of (i) whether they have been audited because they have been denounced or not; (ii) the number of denouncements for themselves or the others, and (iii) who else has been audited in the group. Finally, players have the possibility, at any moment, to check the history of past periods.

In both treatments, two subjects within the five members of the group are audited and, therefore, the operating cost for the tax administration is kept constant. Under the random-based audit scheme the two audited subjects are randomly selected, while the selection process depends on the relative number of denouncements under the whistleblowing-based audit scheme. Precisely, the two audited subjects are those who have been the most denounced in the current period. If there are more than two players with the maximum number of denouncements, the two audited subjects are randomly drawn within this set. If there is only one subject with the maximum number of denouncements, he/she is automatically selected and the second audited subject is selected among those remaining and showing the maximum number of denouncements. Once again, in case of equality in this set, one subject is randomly drawn within this set. This process follows up this way until the selection of two players in the group.

[4] All periods of this part were paid.
[5] Experimental Currency Unit. The conversion rate was given in the instructions: 100 ecus = 0.75 euros.
[6] There are four lines, one for each member B, C, D, and E.

3. Theoretical frameword and predictions

Consider a population of N individuals indexed $i = 1, 2, \ldots, N$. Each individual i has gross income $W_i > 0$ as private information (unknown by the tax administration) and faces the same proportional income tax rate $t \in (0, 1)$. Because gross income is a private information, individuals may under-report their true wealth. If an individual i chooses to report $X_i \in [0, W_i]$ to the tax administration, then the amount of gross income evaded is $e_i \in [0, W_i]$, with

$$e_i = W_i - X_i \tag{1}$$

The tax administration is assumed to audit $n \in \{2, ..., N\}$ agents within the population.The audit procedure is supposed to perfectly reveal the true income. Thus, the wealth of a non-audited indivual is $[1-t]\, W_i + te_i$, while the wealth of an audited individual is $[1-t]\, W_i - \theta te_i$, where θ is the fine rate applied to the amount of tax evaded. An individual i is audited with probability p_i. In this context, the net wealth of an individual i is an endogenous random variable which may be written:

$$\widetilde{w}_i = w_i + \widetilde{t}e_i \tag{2}$$

where $w_i = [1-t]\, W_i$ is his exogenous net wealth with no evasion and where $\widetilde{t} = (-\theta t,\, p_i;\, t,\, 1-p_i)$ is a simple binary lottery taking value $-\theta t$ with probability p_i and value t with probability $1 - p_i$. Thus, evasion may be viewed as a gamble and an individual's decision to evade depends on his willingness to bear the risk of a random tax rate $\widetilde{t}$. No exposition to this risk is obtained with no evasion ($e_i = 0$), while full exposition is obtained with full evasion ($e_i = W_i$). Clearly, all risk-neutral individuals would be indifferent between any level of evasion if and only if $\widetilde{t}$ is actuarially neutral with $E\widetilde{t} = 0$. Otherwise, all risk-neutral agents would either chose no evasion if $\widetilde{t}$ is an unfair gamble with $E\widetilde{t} < 0$, or full evasion if $\widetilde{t}$ is a fair one with $E\widetilde{t} > 0$.

In the treatment where the audit procedure follows a random-based audit scheme, subjects only have to choose the amount of income to report to the tax administration and each subject is audited with probability $n/N = 2/5$. According to the parameters of the experiment, the random return of evasion is $\widetilde{t} = (-0.3,\, 2/5;\, 0.2,\, 3/5)$. Thus, evasion is an actuarially-neutral gamble with $E\widetilde{t} = 0$. Therefore all risk-neutral subjects should be indifferent between all possible level of evasion. As a result, full evasion ($e_i = W_i$) is the optimal choice for all risk-prone subjects – who, by definition, accept all the gambles for which risk-neutral subjects are indifferent – whereas no evasion ($e_i = 0$) is the optimal choice for all risk-averse subjects who, by definition, reject all the gambles for which risk-neutral agent are indifferent.

In the treatment where the audit procedure is based on denouncements, for each member of their group for whom they observe the amount declared, subjects are also asked to signal evasion or no-evasion. Clearly, because relatively more denounced subjects are audited with relatively greater probability, to blow the whistle on others would either decrease or keep constant one own audit probability and, therefore, whistleblowing is a weakly dominant strategy. Indeed, whatever

the amount declared and the signal reported to the tax administration by the other members of his/her group, a subject would perform at least as good by signaling any other member as an evader to the tax administration. Therefore, whenever subjects' preferences are independent, each subject would systematically report as much evaders as possible to the tax administration. As a result, if each subject adopts his weakly dominant strategy, each subject is denounced four times and is audited with the same probability $p_i = 2/5$, as in the RBAS treatment. We conclude that, under these assumptions, no difference should be observed among our two treatments.

4. Experimental results

Result 1. *The monetary amount of tax evasion is smaller under the whistleblowing-based audit scheme than under the random-based audit scheme.*

[INSERT TABLE 1 AND FIGURE 1 HERE]

Table 1 reports the monetary amount of tax evasion by group in each treatment. Figure 1 reports the evolution of the average monetary amount of tax evasion over time in each treatment. Introducing whistleblowing opportunities decreases the average tax evasion as soon as the first period of play, that is just after the reading of the instructions and therefore without any experience with the audit scheme. In period 1, players on average evades 30.00% of their income under the RBAS and 16.88% under the WBAS, a statistically significant lower value (Mann Whitney two-sided[7] p-value = 0.083).[8] The initial treatment effect shows to be stable among periods, the dotted curve in figure 1 being always below the plain one. Precisely, on average taxpayers evade 16.80% of their income under the WBAS against 38.13% under the RBAS (MW p-value = 0.010). By the very last period of the game the difference between both audit schemes is even higher, 13.75% against 43.35% (MW p-value = 0.007).

[INSERT FIGURE 2 HERE]

Figure 2 depicts the distribution of tax evasion in both treatments. The vertical bar represents the frequency of observation of the corresponding tax evasion grouped into five brackets: [0-20],]20-40],]40-60],]60-80],]80-100]. One can observe that compared to the RBAS, the WBAS decreases the frequency of the highest class of evasion and conversely increases the frequency of the lowest. A chi-square test confirms that the two distributions differ significantly ($\chi^2(4) = 138.951$, p-value< 0.001). In contrast, there is no statistically significant difference in average frequencies of tax evasion among treatments (55.63% under the RBAS and 51.00% under the WBAS; MW p-value = 0.318).

[7] Thereafter MW. Since the statistically independent unit in our experiment is the group, the MW tests are performed on data by group, the statistical values of each of the 8 groups of one treatment is compared to the (same) statistical values of each of the 8 groups of the other treatment.

[8] Statistical analysis has been done using the R software (R Core Team 2013).

Moreover, the amount of tax evasion is smaller in the WBAS as soon as the first period of play - where no audit as ever been implemented so that it is the only period in the experiment where we can observe the pure indirect effect of audit - which means that taxpayers expect the audit probability to be higher than in the RBAS. This highlight the greater dissuasive effect of the WBAS, and suggests that taxpayers expect the audit probability to be higher in case of evasion.

Result 2. *The whistleblowing-based audit scheme better targets evaders than the random-based audit scheme.*

[INSERT TABLE 2 AND FIGURE 3 HERE]

In our model, as in Mealem et al. (2010), all subjects are expected to blow the whistle strategically, that is by denouncing honest taxpayers in order to reduce their own probability of being audited (because it is a weakly dominant strategy, as discussed in section 3). However, in the experiment we observed only 39.63% of such false strategic denounciations (table 2). On average taxpayers blew the whistle on 2.45 group members, which is significantly less than four (Wilcoxon one-sided p-value = 0.004). Figure 3 shows that the average monetary amount of tax evasion and the average number of denouncements follow a common trend.

[INSERT TABLE 3 AND FIGURE 4 HERE]

To question subjects' overestimation of the probability of detection, table 3 reports, by treatment, the empirical probability of detection for evaders and non evaders. We observe that the empirical probability for an evader to be detected is 50.01% under the WBAS, whereas it is 38.84% under the RBAS. Recalling that the theoretical probability of detection is $2/5 = 40\%$ in the experiment, we can assert that the WBAS allows for a better targeting of evaders at constant operating cost. Furthermore, the empirical probability for a non evader to be detected is 32.25% under the WBAS, whereas it is 38.75% under the RBAS. This suggests that the WBAS has got a great advantage in terms of procedural equity. In addition, figure 4 supports that there exists a positive correlation between the number of time a subject is denounced and the monetary amount of his/her tax evasion. Averages are positively correlated (Pearson correlation test $\rho = 0.402$, p-value = 0.010) and there exists a positive linear relationship (coefficient 0.017 p-value = 0.010).

Result 3. *The tax levy is significantly greater under the whistleblowing-based audit scheme than under the random-based audit scheme.*

Finally, an important question for the tax administration is the impact of the audit scheme on the amount of tax collected. Table 4 details its structure by distinguishing the tax levy from the tax adjustment (made of reimbursements and penalties). Recall that, if everyone in the group reports its full income in every period, the total amount collected by the tax authority for that group would be 2000. The tax levy is significantly greater under the WBAS, up to 1663.95 (compared to 1237.33 under the RBAS, MW p-value = 0.010). In addition, a higher compliance level implies a lower tax adjustment. Thus, the average penalty in the WBAS is half smaller, down to 373.25 (compared to 766.56 under the RBAS, MW p-value = 0.007). In line with Result 1, the indirect effect of the audit, which is of first importance for tax administrations, is strengthened by the dissuasive power of whistleblowing.

[INSERT TABLE 4 AND TABLE 5 HERE]

So far we analyzed the data at the group level. To conclude this section we will focus on individual choice and more precisely on the determinants of subjects' evasion decision. To this end we estimate panel data models, where the dependent variable is the reported income of an individual i in period t. The independent variables are the treatment, the reported income in $t-1$, having or not being audited in $t-1$ and the number of denouncements made by the players in $t-1$. We also added three variables that subjects could have easily computed: the average income reported by the other taxpayers in the group in $t-1$, the minimum and the maximum of the reported income in the group in $t-1$. Finally we included the taxpayer's gender in the model. Estimations are reported in table 5. In the left column we estimated a model with random individual effects.[9] In the second and third columns we estimated dynamic panel model following Arellano & Bond (1991)'s procedure.[10] The second column reports estimated coefficients for the whistleblowing treatment and the third column for the random treatment.

As already mentioned there is a strong treatment effect. In line with Result 1, the introduction of whistleblowing opportunities significantly increases the income reported by subjects. The independent variable 'audit' has a strong impact on the amount reported in the current period. Noteworthy the sign of the impact differs among treatments. Under the RBAS, consecutively to an audit, taxpayers significantly decreased their reported income, recalling the bomb crater effect (Mittone 2006). Conversely the audit has an opposite positive effect under the WBAS. This suggests that while under a RBAS subjects seem to consider that being audited decreases the probability to be audited in the next period, with the WBAS this perceived probability is increased. Also, it is only under the WBAS that subjects take into account the average reported income by the other members of their group. In particular, if the average reported income of a subject's group increases, the amount the subject reports increases too. Finally, we observed no gender effect.

[9] We used the R package plm (Croissant & Millo 2008).

[10] We used the pgmm command of the plm package. The instrumental variable of the model is the report with a lag of two periods.

5. Conclusion

This paper studies the impact of a whistleblowing-based audit scheme (WBAS) upon taxpayers' reporting decisions. To this purpose, we built an experiment aiming at comparing its relative efficiency compared to that of a standard random-based audit scheme (RBAS), keeping operating costs constant for the tax administration. Thus in both treatments the same number of taxpayers are audited. When whistleblowing opportunities are open, audits are triggered by decreasing order of denouncements scores. Therefore, a potential drawback of whistleblowing schemes is that taxpayers may strategically use denunciation to decrease their own probability of being audited, through extensive and false denunciations. This is our theoretical prediction since denuncing anyone is a weakly dominant strategy, such that both audit schemes become equivalent. However, in our experiment the WBAS appears to be more efficient than the RBAS as (i) the monetary amount of tax evasion decreases, (ii) targeting of evaders is improved and (iii) the tax levy raises.

In practice, audit efficiency is discussed by distinguishing its direct (or deterrent) and indirect (or dissuasive) effects. Our experimental data show that the WBAS dominates the RBAS on both dimensions. Regarding the direct effect, the WBAS provides a better targetting on evaders, so that procedural equity is improved. Whereas concerning the indirect effect, our results show that taxpayers react to the WBAS by a strong increase in reported income from the very first period, even without observing to what extent whistleblowing is actually used in the population. Thus, taxpayers seem to believe, *ex ante*, that people are prone to blow the whistle so that their likelihood of being audited would be greater than under the RBAS. In addition, although the amount of collected tax is almost similar under both audit schemes in our experiment, it may well be strongly different in practice as post audit tax returns are very low and costly to levy for the tax administration. For instance, in France, two years after prosecution, the tax administration has a post audit rate of return (on penalties and due taxes) around 40%. Therefore, the relative superiority of the WBAS in the experiment is expected to be emphasized in practice.

References

Allingham, M. & Sandmo, A. (1972), 'Income Tax Evasion: a Theoretical Analysis', *Journal of Public Economics* **1**, 323–338.

Arellano, M. & Bond, S. (1991), 'Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Equations'.

Beaud, M. & Willinger, M. (2015), 'Are People Risk-Vulnerable', *Management Science* **61**(3), 624–636.

Beck, P. & Jung, W. (1989), 'Taxpayer Reporting Decisions and Auditing under Information Asymetry', *The Accounting Review* **64**, 468–487.

Cremer, H., Marchand, M. & Pestieau, P. (1990), 'Evading, Auditing and Taxing: The Equity-Compliance trade-off', *Journal of Public Economics* **43**, 67–92.

Croissant, Y. & Millo, G. (2008), 'Panel Data Econometrics in R: The plm Package', *Journal of Statistical Software* **27**.

Erard, B. & Feinstein, J. (1994), 'Honesty and Evasion in the Tax Compliance Game', *Rand Journal of Economics* **25**, 1–19.

Greenberg, J. (1984), 'Avoiding Tax Avoidance: A (repeated) Game Theoretic Approach', *Journal of Economic Theory* **32**, 1–13.

Greiner, B. (2004), The Online Recruitment System ORSEE 2.0 - A Guide for the Organization of Experiments in Economics, Working Paper Series in Economics, University of Cologne, Department of Economics.

Landsberger, M. & Meilijson, I. (1982), 'Incentives Generating State Dependent Penalty Schemes', *Journal of Public Economics* **19**, 333–352.

Masclet, D., Montmarquette, C. & Viennot-Briot, N. (2013), 'Comment rÃ©duire la fraude fiscale? Une expÃ©rience sur le signalement', *Project Report, Cirano* .

Mealem, Y., Tobol, Y. & Yaniv, G. (2010), 'Whistleblowers as a Deterrent to Tax Evasion', *Public Finance Review* **38**, 306–320.

Mittone, L. (2006), 'Dynamic behaviour in tax evasion: An experimental approach', *Journal of Socio-Economics* **35**(5), 813–835.

R Core Team (2013), *R: A Language and Environment for Statistical Computing*, R Foundation for Statistical Computing, Vienna, Austria. URL: http://www.R-project.org.

Reinganuum, J. & Wilde, L. (1988), 'A Note on Enforcement Uncertainty and Taxpayer Compliance', *Quarterly Journal of Economics* **103**, 793–798.

Rhoades, S. (1999), 'The Impact of Multiple Component Reporting on Tax Compliance and Audits Strategies', *The Accounting Review* **74**, 63–85.

Sanchez, I. & Sobel, J. (1993), 'Hierarchical Design and Enforcement of IncomeTax Policies', *Journal of Public Economics* **50**, 345–369.

Yaniv, G. (2001), 'Revenge, Tax Informing, and the Optimal Bounty', *Journal of Public Economic Theory* **3**, 225–233.

Yaniv, G. (2013), 'Tax Evasion, Conspicuous Consumption and the Income Tax Rate', *Public Finance Review* **41**, 302–316.

Groups	Random	Whistleblowing
G1	62.54	3.54
G2	21.11	43.03
G3	50.88	7.03
G4	40.24	5.70
G5	26.90	17.91
G6	21.60	24.05
G7	38.80	21.03
G8	43.00	12.13
Av.	38.13	16.80

Table 1: Average amount of tax evasion by treatment and by group

Groups	Non-strategic	Strategic
G1	67.00	33.00
G2	67.00	33.00
G3	72.00	28.00
G4	50.00	50.00
G5	57.00	43.00
G6	43.00	57.00
G7	67.00	33.00
G8	60.00	40.00
Averages	60.68	39.63

Table 2: Average frequencies of non-strategic and strategic denunciation

Groups	Tax evader		Tax honest	
	Random	Whistleblowing	Random	Whistleblowing
G1	41.67	53.12	31.25	33.82
G2	42.03	45.21	35.48	25.93
G3	38.18	46.15	42.22	33.33
G4	34.04	85.19	45.28	23.29
G5	33.33	38.46	43.75	40.98
G6	33.33	40.26	43.75	39.13
G7	45.76	43.9	31.71	37.29
G8	42.37	47.76	36.59	24.24
Av.	38.84	50.01	38.75	32.25

Table 3: Average frequency of audit of a tax-payer depending on whether he evades or not

Groups	Tax levy		Tax adjustment	
	Random	Whistleblowing	Random	Whistleblowing
G1	749.20	1929.20	1229.50	124.50
G2	1577.80	1139.40	459.50	901.50
G3	982.40	1859.40	964.00	184.00
G4	1195.20	1886.00	684.50	265.00
G5	1462.00	1641.80	480.00	289.00
G6	1568.00	1519.00	371.00	528.00
G7	1224.00	1579.40	959.00	364.00
G8	1140.00	1757.40	985.00	330.00
Average	1237.33	1663.95	766.56	373.25

Table 4: Total amount (tax levy and tax adjustment) collected by the tax administration

Dep. var: *Reported income*	Panel All	Arellano Bond Whistleblowing	Arellano Bond Random
Balanced panel	N=80, T=18	N=40, T=20	N=40, T=20
Nb. of observations		680	680
(Intercept)	76.186 443 ***		
as.factor(treatment) *Whistleblowing*	18.757 191 ***		
as.numeric(Period)	0.127 162	0.093 741	−0.026 105
lag(reported income, 1)		0.215 641 **	0.185 616 *
lag(audit, 1)	−7.476 314 ***	9.894 405 ***	−18.572 226 ***
lag(audit, 2)	−5.404 871 **	−1.220 487	−4.728 671
lag(Nb. denouncements by the player, 1)		6.657 847 **	
lag(Nb. denouncements by the player, 2)		0.058 938	
lag(Av. observed reported inc., 1)	0.042 473	0.379 304 ·	0.190 176
lag(Min observed reported inc., 1)	0.024 187	−0.082 637	−0.088 259
lag(Max observed reported inc., 1)	−0.078 821	0.492 224	−0.131 385
Investment in portfolio choice	−1.773 904 ·		
as.factor(Gender) *Woman*	3.384 928		
F-statistic	<0.001		
Wald test		<0.001	<0.001

Signif. codes: 0 '∗ ∗ ∗' 0.001 '∗∗' 0.01 '∗' 0.05 '.' 0.1 ' ' 1

Table 5: Reported income's determinants

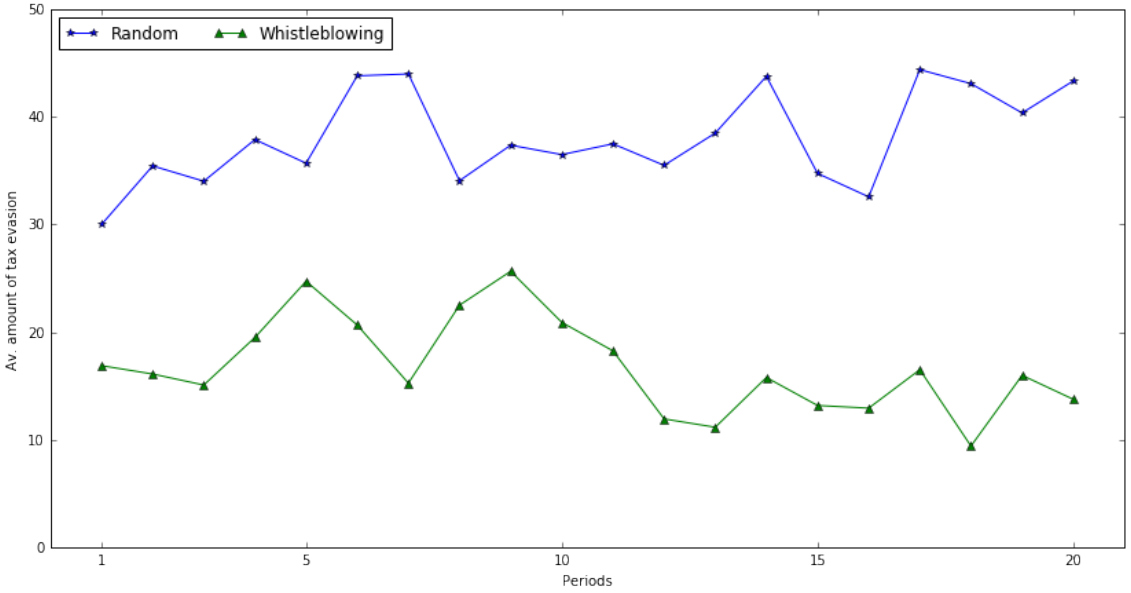

Figure 1: Evolution of average tax evasion

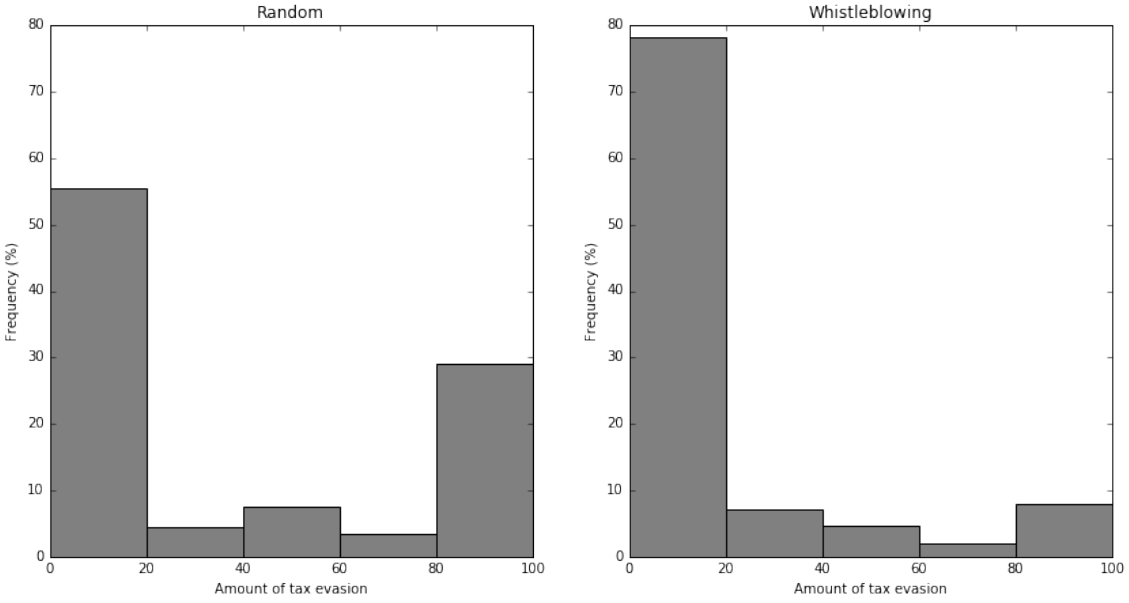

Figure 2: Distribution of tax evasion

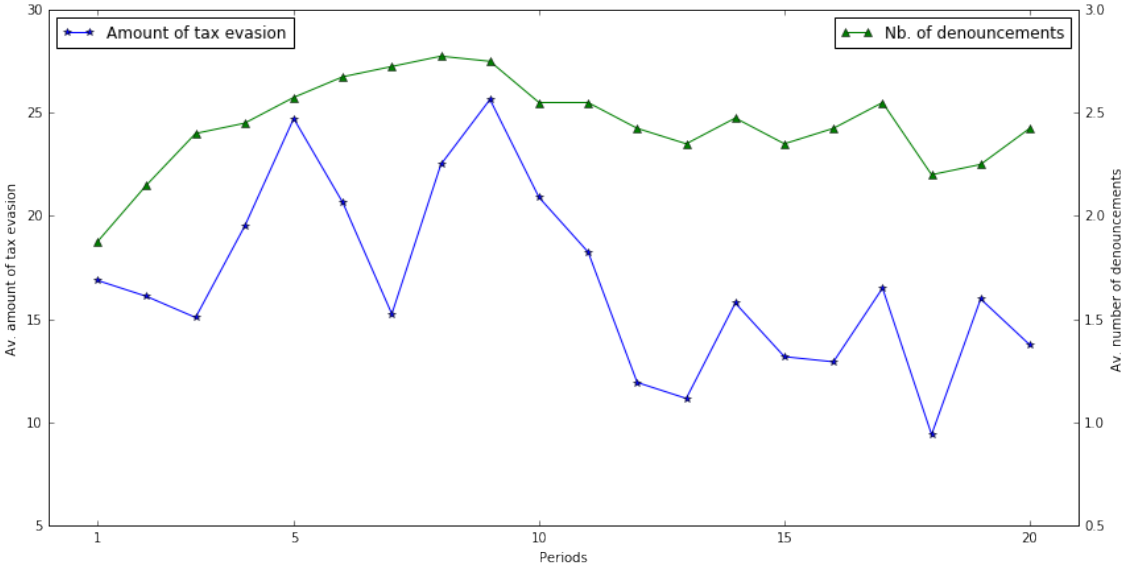

Figure 3: Evolution of the average amount of tax evasion and the average number of denouncements

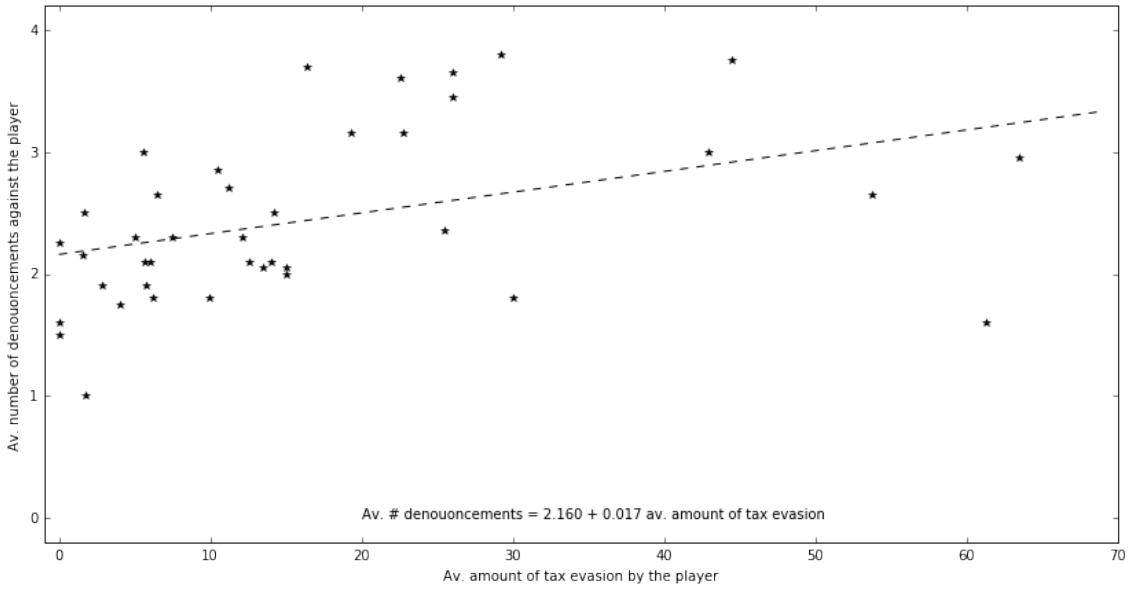

Figure 4: Correlation and linear model between the average number of denouncements against the taxpayer and his average amount of tax evasion

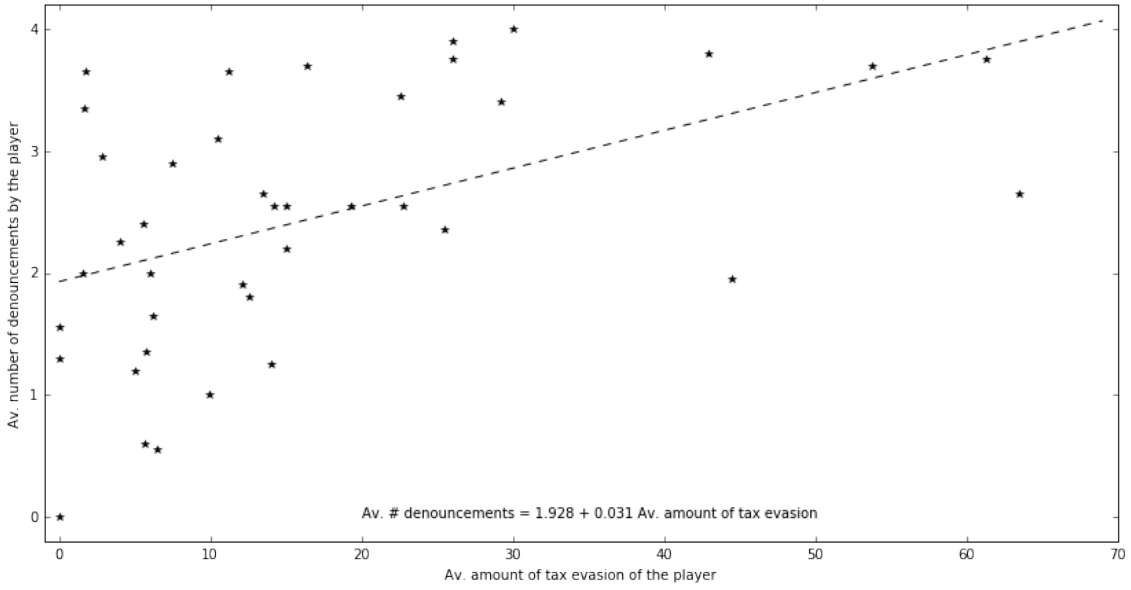

Figure 5: Correlation and linear model between the average number of denouncements by the taxpayer and his average amount of tax evasion

Instructions of the whistleblowing treatment (translated from french)

Part 2

At the beginning of the game the central computer will randomly form groups of five. The composition of those groups will remain unchanged until the end of the experiment. You cannot identify other members of your group and they cannot identify you. Each of the other members of your group is identified by a letter: B, C, D and E. The identifier assigned to each of the other members of your group remains unchanged until the end of the experiment. So the B member of your group will always be the same person, same thing for the members C, D and E. The experiment has 20 periods. Each period runs identically, in four steps. The rest of the instructions detail each of these steps.

Step1 : Income reporting.
At the beginning of each period you receive an income of 100 ecus. You must report this income. To do this, enter the amount you declare on the screen. You are free to declare the amount you want among the integer between 0 and 100 ecus, so 0, 1, 2, 3 ..., 98, 99 or 100 ecus. You are subject to a levy on your income up to 20% of reported income. This amount is deducted from your income.

Levy= reported income x 0.2

Example: You report an income of 50 *ecus. The levy on reported income is* $0.2 \times 50 = 10$ *ecus. At the end of step 1, your gain is equal to* $100 - 10 = 90$ *ecus.*

Step 2 : Information and whistleblowing.
In this step, you are informed of the amount levied on the income you reported. You are also informed of the income reported by each of the other members of your group. For each of the other members of your group you must decide whether or not you denounce him/her to the central computer. The decision whether to denounce the other members of your group does not affect your earnings, and the other members of your group are not informed of your decision. Denunciation only affects the audit probability for other group members. The audit is implemented by the central computer, according to the procedure described in the following paragraph.

Step 3 : Audits and penalties.
In this step the central computer audits two members of your group. The audit consists in the verification of the declared income by comparison to the 100 ecus of real income. The rule for determining the two audited members in the group depends on the number of denunciations. Each member may be denounced at max four times (by each other member of the group).

The procedure is as follows. The central computer starts by looking at whether there are members of the group who have four denunciations. If there are more than two, he shall draw

two of them at random. If there are exactly two, these are audited, and if there is one then it is automatically audited and the central computer then checks whether there are members who have three denunciations. If there is more than one then it draws randomly the one who will be the second one audited. If there is exactly one then it is the second member audited, and if there is none, then the central computer looks at whether there are members with two denunciations ... so on so far until the central computer has two persons to audit.

Example 1: Member A has four denunciations, members C and D have three denunciations, member E has one and member B has zero denunciation. In this case the two members controlled by the central computer are, on the one hand, member A, and on the other hand either member C or D depending on the random draw.

Example 2: Members B, C and E have three denunciations, member D has one and member A has zero denunciation. In this case the two members controlled by the computer are randomly drawn from members B, C and E.

Example 3: Member C has one denunciation, and the other four members have zero denunciation. In this case the two members controlled by the central computer are on the one hand member C, and on the other hand, a member drawn among members A, B, D and E.

Audited subjects for whom the central computer finds a difference between the income declared and the 100 ecus of real income pay a penalty equal to 2.5 times the amount of the unpaid levy.

$$\text{Penalty} = [(\text{income - reported income}) \text{ x } 0.2] \text{ x } 2.5$$

Example: one of the two members of your group audited by the central computer reported100 ecus, he therefore does not pay a penalty. The other has declared 60 ecus, he must therefore pay a penalty equal to $[(100 - 60) \times 0.2] \times 2.5 = 20$ *ecus.*

There is no screen for this step, the audits are carried out by the central computer and the penalties are calculated automatically by the latter and appear in the screen "summary of the period".

Step 4 : Period payoff and summary of the current period.
The period payoff is equal to the income less the levy less the possible penalty.

$$\text{Period payoff} = \text{income - levy - possible penalty}$$

After step 3, the summary of the period is displayed, it summarizes what happened in the current period. The screen is divided into three areas. In the upper box, you are reminded of the income you reported, the amount of the income declared by each of the other members of your group and your decision to denounce them or not. In the center area, you are informed whether you have been controled and if so the potential amount of the penalty you paid. In the bottom area you are informed of your earnings for the current period.

Last details.

At any time you can consult the history of the past periods, by clicking on the button "History" located at the top right of the various screens. The history is a table with information from previous periods. This table contains 16 columns: Period, Income, Declared income, Withdrawal, Declared income member B, Declared income member C, Income declared member D, Income declared member E, Denunciation of member B, Denunciation of member C, Denunciation of member D, Denunciation of member E, Control, Penalty, Period payoff, Cumulative payoff.

Your payoff for this part of the experience is equal to your cumulative payoff over the 20 periods, converted into euro according to the following conversion rate: 100 ecus = 0.75 euro.

Documents de Recherche parus en 2017

DR n°2017 - 01: Tristan LE COTTY, Elodie MAITRE D'HOTEL, Raphaël SOUBEYRAN, Julie SUBERVIE
« Linking Risk Aversion, Time Preference and Fertilizer Use in Burkina Faso»

DR n°2017 - 02: Cécile BAZART, Aurélie BONEIN
« The Strength of the Symbol: Are we Willing to Punish Evaders ?»

DR n°2017 - 03: Nicolas GRAVEL, Brice MAGDALOU, Patrick MOYES
« Hammond's Equity Principle and the Measurement of Ordinal Inequalities?»

DR n°2017 - 04: Cécile bazart ? Mickael BEAD, Dimitri DUBOIS
« Whistleblowing vs random audit : An experimental test of relative efficiency

Contact : garnierl@supagro.inra.fr/ 04 99 61 31 21