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Highlights

- We investigate experimentally both the effectiveness and the determinants of whistleblowing decisions.
- We compare treatments i) with and without peer monitoring and ii) with and without peer reporting
- Monitoring alone ha a weak negative effect on the income-declaration rate;
- The opportunity to report tax evaders has a positive and highly significant effect on the level of income reported;
- Information on how taxes are spent has no significant impact on either tax compliance or peer reporting.

Can Whistleblower Programs Reduce Tax Evasion? Experimental Evidence

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Abstract: There are many ways of tackling tax evasion. The traditional strategies implemented by tax authorities fight fiscal fraud through audits and penalties. However, there also exist a plethora of unconventional methods, such as whistleblower programs. Although there is rich economic literature on tax evasion, auditing and penalties, tax agencies' heavy reliance on whistleblower programs has mostly been ignored. We ran an experiment in which taxpayers can punish tax evaders by reporting them to the authorities, even though it is costly for them to do so and despite the lack of any material benefit from doing so. Information on other taxpayers' compliance rates together with the opportunity to report tax evaders have a positive and very significant effect on the level of income reported. Observing the compliance rates of other participants alone does not suffice to increase tax revenues.

Keywords: fiscal fraud, whistleblowers, ambiguous risk, laboratory experiment.
JEL Code: H26, H31, C91.

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"It is not always through the perfect goodness of virtue that one obeys the law, but sometimes it is through fear of punishment." Aquinas

Every year, the government forgoes considerable sums in lost revenues, and the population suffers substantial welfare losses via reduced public services because of tax evasion. It is, therefore, important that our society understand the determinants of tax evasion and the effectiveness of the instruments that have been designed to curb it.

There are many ways of tackling tax evasion. The traditional strategies implemented by tax authorities consist of fighting fiscal fraud through audits and penalties. Following Becker's seminal article in 1968, the economics of crime has traditionally focused on how the probability and severity of punishment deter potential criminal activities.[4] In the domain of taxation, Allingham and Sandmo (1972) and Yitzhaki (1974) developed related models in which taxpayers comply or evade taxes depending on the probability of an audit and the amount of the fine in the case of an audit. Empirical work has confirmed the prediction of the Becker model, revealing a negative effect of deterrence variables on crime and fraud (See Polinsky and Shavell, 2000, for a survey).[5]

Apart from the traditional methods of deterring tax evasion, tax authorities also resort to less conventional methods, including advertising campaigns to remind people of the Law, warnings about the consequences of tax evasion for cheaters, publishing the names of

[4] In the traditional economics-of-crime approach, crime results from the comparison of the expected benefits and costs of illegal activities (Becker, 1968). In Becker's model, extended by Ehrlich (1973), criminals maximize their expected utility by comparing the monetary returns from the legal sector to the net expected gain from crime.

[5] In the context of the firm, monitoring mechanisms have been widely studied in the accounting and control literature (e.g., Chow et al., 1988; Evans et al., 2001; Zhang, 2008). Varying employee compensation can be an alternative to monitoring in deterring fraudulent behavior in firms. This may consist for instance in reducing employees' pay in the case of cheating such as theft (e.g. Greenberg 1990). On the contrary, efficiency-wage theory proposes that higher pay will yield higher productivity by i) inducing reciprocity, ii) reducing cheating and motivating employees to exert greater effort and iii) attracting higher-quality employees (Malcomson, 1981; Yellen, 1984; Shapiro and Stiglitz, 1984; Akerlof and Yellen, 1990; Fehr and Gachter, 2000a). For instance, using data from the retail industry, Chen and Sandino (2012) find that relative wages are negatively correlated with employee theft after controlling for employee characteristics, monitoring and the socio-economic environment.

delinquent taxpayers or other shaming techniques (See Kirsch, 2004).[6] Tax agencies also often rely on whistleblower programs by paying informants to conduct tax investigations. Whistleblower programs are based on the idea that agents themselves are often in a better position to observe each other, whereas such information may be costly for the principal to obtain.[7] In the US, the Internal Revenue Service (IRS) established the Whistleblower Office in 2006, which rewards people who blow the whistle on taxpayers who underreport their tax liabilities. For instance, in the 2011 fiscal year, the IRS paid a total of $8 million to informants, who provided information that led to the collection of an additional $48 million in taxes and penalties.[8] In the same vein, the Australian Taxation Office (ATO) posted the following statement directly addressed to taxpayers on its website: "*ATO is committed to targeting tax evasion, and you can help us make sure everyone pays his or her fair share of tax*." The Italian government also introduced a similar program called *evasori* to curb tax evasion by encouraging citizens to report any known cases of tax evasion on an anonymous website. By the end of June 2010, 75,341 cases of fraud had been denounced, for a total of €18,367,338.[9] A similar whistleblower program has also been implemented in Greece by the Financial and Economic Crime

[6] For instance, in the context of tax evasion, Kirsch (2004) reports several evidences of shaming techniques such as the publication by the Congress of the United States of the names of individuals who renounced citizenship to avoid taxes.

[7] Researchers have long studied the potential value of information that one agent possesses about another's actions in the context of peer monitoring mechanisms (e.g., Kandel and Lazear, 1992; Barron and Paulson-Gjerde, 1997). The principal multi-agents relationship literature suggests that mutual monitoring systems can improve the principal's contractual position significantly at a relatively low cost if she can elicit information possessed by one agent about the others when agents can accurately observe each other. The principal may thus encourage peer reporting and base each agent's compensation on the peer's report. In some cases, managers encourage peer reporting via appropriate remuneration schemes that invite employees to report their peers (Trevino and Victor, 1992; Barron and Paulson-Gjerde, 1997; Butler et al., 2017). Some models have considered such settings, where each agent observes the other agent's action and can truthfully report it to the principal (Demski et al., 1988; Fischer and Hughes, 1997). In these incentive schemes, the agents are monetary compensated based on their peer's report (Ma, 1988, Zhang, 2008). For instance, Ma (1988) sets out the conditions under which the principal can achieve the first best by implementing a peer-reporting system. Zhang (2008) investigates how the agent's fairness perception of the principal and inter-agent communication affect the honesty of agent behavior under a peer-reporting system.

[8] See IRS. https://www.irs.gov/pub/whistleblower/fy2011_annual_report.pdf,

[9] Source: Le Monde, June 3rd 2010.

Unit (S.D.O.E) and resulted in an increase in total fines from €1.7 billion in 2009 to €4.5 billion in 2012.[10]

In this current paper, we attempt to contribute to the existing literature on tax evasion by experimentally investigating the effectiveness of whistleblower programs.[11] While some experiments have been conducted to test the effectiveness of whistleblower programs in different contexts such as illegal cartel formation (Apesteguia et al., 2007; Bigoni et al., 2012)[12], employee-employer relationships (Carpenter et al., 2017; Bartuli et al., 2016)[13], cheating or lying games (Reuben and Stephenson, 2013; Schmolke and Utikal, 2016;

[10] According to the daily newspaper Kathimerini, the number of tax informers is booming in Greece, with a fourfold increase in reports of suspected fraud to the financial police in 2010 amid the serious economic crisis. The anti-fraud brigade, the SDOE, received 18 500 reports in 2010, as against 4,500 the previous year and 4000 in 2008.

[11] Laboratory experiments have the advantage of eliciting behaviors instead of inferring taxpayers' intentions through surveys. In contrast to surveys, experiments rely on actual decisions instead of subjectively reported behavior. Laboratory experiments circumvent a number of the difficulties in survey data, such as the reluctance to report acts of noncompliance or ad hoc rationalizations for behavior (See Mascagni, 2016, for a review of experiments on tax evasion). In general, experiments on tax evasion tend to support the hypothesis that the expected punishment (that is, the size of sanctions discounted by the probability of audit) is important (for example, Guala and Mittone, 2005). Alm et al. (1992) report that uncertainty over the probability of audit can increase compliance. Among others, Clark et al. (2004) present experimental results showing that biased estimates of audit probability explain the extent of voluntary compliance. Johnson et al. (2010) provide insights using an experimental approach to evaluate the effects of sales-tax monitoring and the determinants of sales-tax compliance. The results indicate that if comprehensive monitoring is instituted without complementary policies, an increase in tax revenues is unlikely. The reason is that individuals may try to recover their losses following any policy changes, even if this means taking more risks. Lefebvre et al. (2013), Luttmer and Singhal (2014) and other experimental contributions suggest that tax morale plays an important role, even though the effects are difficult to measure. Hallsworth et al. (2017) appeal to natural field experiments to show how social-norm messages can enhance tax compliance.

[12] Apesteguia, Dufwenberg and Selten (2007) studied experimentally leniency and rewards to whistleblowers in the context of illegal cartel formation among firms. Their results suggest that rewarding whistleblowers increases the likelihood of whistleblowing without reducing market prices. Bigoni et al. (2012) also find that offering a monetary reward to the whistleblowers leads to high reporting rates that strongly deter cartel formation.

[13] Bartuli et al. (2016) study experimentally whistleblowing in an employee-organization context in order to test whether subjects in the role of employees are willing to blow the whistle on their managers' decisions to withhold money that is destined for a charitable purpose. The authors find that employees who are more altruistic and more aware of ethical issues are more likely to report wrongdoing. Carpenter et al. (2017) experimentally investigate peer reporting in the context of a firm with sharing profits. The authors find that profit sharing motivates workers, who are better informed about their co-workers' behavior, to enforce higher effort by the mean of peer reporting shirkers.

Butler et al. 2017)[14] less is known about the effectiveness of whistleblower programs in the context of tax evasion. More specifically, whistleblower programs have mostly been ignored in the tax-evasion literature.[15] Notable exceptions are Yaniv (2001) and Mealem et al. (2008). Yaniv (2001) presents a model in which individuals can decide to blow the whistle on tax evaders. Mealem et al. (2008) compare the tax agency's performance under a one-round blind-audit policy and a two-round whistleblowing-intensive policy that allows whistleblowers to denounce tax evaders. They find that the tax agency is better off running two-round whistleblowing. More related to our study is Bazart et al. (2017) who investigate experimentally whistleblowing programs in the context of tax evasion. The authors compare a benchmark treatment without opportunities to report peers with treatments in which taxpayers can blow the whistle. They show that whistleblowing programs decrease tax evasion significantly. Our study differs from theirs in several dimensions. In particular, we investigate whistleblowing decisions in the absence of monetary incentives. Furthermore, we attempt to isolate the pure role of monitoring from peer reporting effect by testing whether providing information about how tax revenue is used might influence both tax compliance and peer reporting decisions.

Precisely, the contribution of our study to the existing literature is threefold. First, we attempt to investigate experimentally the efficiency of whistleblowing programs on tax compliance in a context where those programs are not rewarded by the central authority.

[14] Reuben and Stephenson (2013) ran a laboratory experiment in which participants play a repeated "whistleblowing" game. In this game, subjects first draw a random number that corresponds to their "true" earnings and they have the opportunity to overstate their earnings, which increases their payoff. In a second step, subjects can observe each other's within a group of peers and have the opportunity to sanction lying subjects by reporting them. The authors find that several individuals are willing to report lies such that in fixed groups lying is unprofitable. Schmolke and Utikal (2016) ran a laboratory experiment to measure the effectiveness of incentives on the willingness to report misconduct to a sanctioning authority. The authors observe that fines for non-reporting insiders, rewards increase the probability of whistleblowing. The authors find the strongest effect for fines. Butler et al. (2017) ran a laboratory experiment to investigate how monetary incentives and expectations of social approval or disapproval affect the decision to blow the whistle. The authors show that financial rewards significantly increase the probability of whistleblowing and the possibility of social judgment increases whistleblowing when the public is aware of the negative externalities generated by fraud.

[15] Slemrod (2016), who reviews new research on tax compliance and enforcement policies at length, does not mention those programs.

This allows us to investigate the non-monetary motives behind peer reporting decisions. While some previous studies have shown that financial rewards significantly increase the probability of whistleblowing (Schmolke and Utikal, 2016; Butler et al., 2017), less is known about the nonmonetary factors behind peer reporting mechanisms. A noteworthy exception is Yaniv (2001) who highlighted from a theoretical point of view the role of non-monetary factors such as the willingness to take revenge with a former close party in producing incentives to inform.[16] Some experimental studies have also shown that individuals do not hesitate to punish cheaters despite the absence of monetary incentives (e.g., Fehr and Gächter, 2000b; Masclet et al., 2003; Carpenter, 2007; Nikiforakis, 2010). However, peer reporting activities are undoubtedly more complicated than peer sanctioning decisions. Indeed, while individuals may not hesitate to punish free-riders, they may be more reluctant to report them to a central authority due to the existence of social norms that prohibit tale-telling (e.g., Greenberger et al. 1987; Trevino and Victor, 1992). The existence of such a social norm of loyalty may thus prevent individuals from peer reporting. Such reluctance may be particularly entrenched among societies that have experienced the plague of denunciations and the proliferation of informers identified by the resistance as one of the greatest threats to the internal cohesion of society under the German occupation, as in Poland or France (Grawboski, 2013). The irony here is that peer reporters may, at the same time, be seen as strongly ethical since tax evasion is unfair but also considered as disloyal by their peers (Trevino and Victor, 1992).

The second aim of this study is to isolate the pure effect of monitoring of tax evasion from peer reporting. Peer reporting mechanisms require monitoring of others, and monitoring by itself may affect behaviors. Whether the introduction of transparency will lead to more or less cheating is a priori unclear. Some studies have reported a positive effect of monitoring because observability may shame tax evaders (e.g., Coricelli et al.,

[16] According to Yaniv (2001), the main reason why people denounce tax evaders is not the pecuniary reward but the desire to obtain revenge against employers, spouses or any norm deviators. Yaniv suggests that this helps explain why the IRS is so tightfisted in rewarding informants who help recover taxes. Yaniv (2001) shows that the bounty rate is relatively low and averaged under 2 percent of the amount recovered by the IRS in the US over the 1992-96 period.

2010).[17] In sharp contrast, other studies have reported a negative effect of observability due to mimicry: seeing other group members profusely cheating may incite individuals to cheat more by mimicry (see Fortin et al., 2007). In this current study, we aim at contributing to this existing literature on the effect of monitoring on tax evasion.

The third aim of this paper is to test whether the willingness to report tax evasion to the central authority is influenced by how the government uses tax revenues. Previous studies have shown that the efficiency of the state (i.e., the return in terms of public expenditures from tax collection) may be an important determinant of tax compliance (e.g., Wenzel, 2002; Alm and Torgler, 2006). For instance, previous studies have reported that efficient institutions may induce less tax avoidance because citizens feel that they are receiving something (i.e., high-quality public services) in return for their taxes (Frey and Feld, 2002; Frey and Torgler, 2007; Torgler and Schneider, 2007). In contrast, citizens may be more likely to avoid taxes, when they perceive that a non-negligible part of the collected revenue is burnt. For instance, Alm et al. (1992) found that some individuals may be willing to pay taxes because they value the goods provided by the government. We conjecture here that knowing that taxes are invested in a program that induces positive externalities (carbon credit, for example), may have a positive impact not only on tax compliance but also on the willingness to report fraud.[18]

Our experimental protocol is a 3X2 design. In the baseline treatment at each period of the game, participants receive an income and are asked to declare their total income and pay the corresponding tax. When audits reveal that participants have underreported their income, they are obliged to pay taxes on the undeclared income and a penalty. Our second treatment (called monitoring treatment) is similar to the baseline treatment except that, in each period, subjects are informed of the declared income rates of the three other

[18] It is common in the literature to assume that tax revenue is squandered or burnt when the experimental treatment does not specify its used. However, as pointed out by an anonymous referee, an alternative explanation is that participants may have not necessarily considered that tax revenue was burnt but rather that it was used to fund another type of public good, namely research if they anticipated that the money saved (by the experimenter) would be used for other experiments, for other research or other possibilities.

group members but have no opportunity to report tax evaders. The comparison of the treatments with and without information allows us to test how monitoring per se affects the degree of tax compliance. Our third (called peer-reporting) treatment is identical to the information treatment except that, in each period, a new step is added in which, after having observed the declared income rates of all group members, each participant can anonymously report tax evasion to the central authority. This treatment allows us to measure the pure effect of peer reporting on tax compliance; it also permits to test whether individuals are willing to report fraud to the central authority despite the absence of any monetary rewards for doing so.

In all three treatments above, participants are not informed about how tax revenues are used. To test whether the perception of how tax revenue is used influences tax compliance and the desire to report tax evasion to the central authority, we ran variants of the three treatments above in which participants were told that the tax revenue was used to finance an environmental public good. Concretely, participants were informed that the taxes were used to buy carbon credits for environmental protection as a proxy of a global environmental public good.[19]

To anticipate our results, we find that: (1) average declaration rates in the monitoring treatments are weakly lower than in the baseline treatment. (2) the opportunity to report tax evaders has a positive and highly significant effect on the level of income reported; and (3) information on how taxes are spent has no significant impact on either tax compliance or peer reporting.

The remainder of the paper is organized as follows. Section 2 presents our experimental design. Section 3 shows the theoretical predictions and behavioral conjectures. Section 4 provides an analysis of the experimental data. Finally, Section 5 discusses our results and concludes.

2. Experimental design

[19] We made clear in the instructions that money collected would be used to buy credit carbon and participants will receive an e-mail attestation to the purchase of carbon credits corresponding to the taxes raised.

2.1. Treatments

Our experiment consists of six treatments. Our baseline treatment is inspired by Johnson et al. (2010)'s taxation game. The participants play 20 periods of baseline treatment. In each period, participants are asked to declare their total income and pay a 40% tax on their declared income. This tax rate is the same for all declared incomes. Each member of a group of 12 receives an income ranging from 20 to 100 EMU (experimental monetary units) randomly drawn by the computer at each period of the game.[20] Participants are informed that the government does not know their income, and has to audit their account to obtain this information. However, this operation is costly. The government therefore, only audits accounts randomly. Following Johnson et al. (2010), the probability of being audited is determined as follows: i) If the reported income is in the bottom 50% of declared incomes, the probability of being audited is 20%; and ii) If the reported income is in the top 50% of declared incomes, the probability of being audited is 10%. An audit finding fraud will automatically trigger audits of the previous two periods.[21] All participants are informed of this. In case tax evasion is detected, the penalty rate is an additional 50% of this 40% (for a penalty-tax rate of 60%).

The second treatment (called "monitoring" treatment) is similar to the baseline except that, in each period, subjects are informed of the declared income rates of the three other group members (each group of 12 was divided up into three groups of four members). This treatment allows us to examine the effects of monitoring on tax compliance.

The third treatment ("peer-reporting") is identical to the monitoring treatment except that a new step is added. After having observed the declared income rates of all group members, each member can anonymously report any observed tax evasion to the central authority. In this treatment, peer reporting of tax evasion is costly: each report costs 2 EMUs. Tax evaders who are reported to the central authority are automatically audited and subject to a penalty. In our peer-reporting treatment, the tax authority does not

[20] In any given period, this amount is identical for all group members (although they do not know this).

[21] Spaeter and Willinger (2006) noted that retroactive audit is quite commonly used in practice by fiscal authorities (France, England, ...). This is also the situation in Canada.

reward informers. This allows us to test whether the sole desire to punish those who do not comply with the Law is sufficient for participants to report evaders.

For each of these three treatments, we implemented a variant in which participants were informed that the taxes collected would be used to fund a global public good. Precisely, participants were told that after the experiment, one period would be randomly chosen by the computer and the total taxes collected for this period by the 12 participants would be used to purchase carbon credits on the online website http://planetair.ca. [22] It was explicitly noted in the instructions that one ton of "Gold Standard carbon offset" costs about $40 and is the highest quality in this domain (see http://www.cdmgoldstandard.org).

2.2. Procedure

432 subjects (72 per treatment) participated in this experiment (see Table 1). The experiment consisted of 36 sessions with 6 sessions per treatment, and each session consisted of 20 periods. Half of the sessions were conducted at the Center for Interuniversity Research and Analysis of Organizations (CIRANO), Montreal, Canada and half at the Center for Research in Economics and Management (CREM), Rennes, France. Some subjects had participated in previous experiments, but all subjects were inexperienced in this particular type of experiment. No subject participated in more than one session. Sessions lasted an average of 90 minutes, including initial instructions and payment. The experiment was programmed in Delphi. Table 1 below summarizes our different experimental treatments.

[Table 1: about here]

At the end of each session, participants were asked to answer a question regarding their usual personal characteristics (age, gender, educational level, etc.) as well as questions

[22] It was made explicit in the instructions that taxes would be used to purchase carbon credits. Instructions are available upon request. The instructions for the treatment with peer reporting and with carbon credits are presented in Appendix A.

elicited from the World Values Survey relative to tax morality, the importance of the religion, politics, environment, work, in life and trust.[23] We also elicited individual risk aversion degree by asking participants to choose between a risky lottery and a certain lottery (5 dollars).[24] Table B in Appendix B gives the precise definition of each variable and shows means of the covariates by treatment separately for the full sample and each experimental site. Descriptive statistics shown in table B do not reveal significant differences across treatments and experimental sites except that the French participants were on average younger and more likely to study economics than Canadians. Also quite intuitively, the mother tongue was French for 93% of French participants while this proportion is 54% for Canadian participants living in Montreal.

3. Theoretical predictions and behavioral conjectures

3.1 Standard theoretical predictions

We first assume that individuals are selfish and attempt to maximize their payoff. The theoretical prediction for the baseline treatment is then straightforward. To calibrate the baseline treatment, we refer to the seminal model developed by Allingham and Sandmo (1972) and Yitzhaki (1974), which builds on the expected-utility model. In the baseline treatment, a risk-neutral participant should never report a positive income.[25] The same prediction applies to the monitoring treatment since treatments with monitoring are identical to the baseline except that participants can now observe the declared rates of their fellow group members. In the peer-reporting treatment, the only subgame perfect

[23] All values variables come from questions in the World Values Survey, which incidentally has been used in analyses of moral qualms concerning tax evasion (see, for example, Alm and Torgler, 2006).

[24] Risk-averse participants are those who opt to accept \$5 rather than a risky lottery with a payoff of \$0 with probability 1/2 and \$12 with probability 1/2. To avoid any income effect, the issue of the lottery was only given at the end of the experiment.

[25] From the parameter specifications discussed above, applying the traditional model, we obtain that in the first period, the expected return of one dollar of undeclared income over the alternative of declaring that dollar is 51.7%, since a first-period audit does not produce fines in the previous two periods: [1 – 0.15*0.40*[1 + 0.50] – (1 – 0.40)]/[1 – 0.40], where 0.15 is the mean audit probability, 0.40 the tax rate and 0.50 the penalty rate). This return falls to 36.7% in the second period (the term in brackets is multiplied by two to include the penalty in the previous period) and to 21.7% (the term in brackets is multiplied by three to account for the penalties in the previous two periods) for the other periods.

equilibrium of the game, whether played once or finitely repeated, is to evade taxation as in the baseline in stage 1, and not to report peers in stage 2, since reporting is costly.

Finally, regarding a variant of our games with credit carbon, predictions are also straightforward: adding the information that the taxes collected will be used to purchase carbon credits should not affect the predictions unless individuals derive utility from a clean environment, which could increase tax compliance.

3.2. Behavioral conjectures

This subsection provides some alternative behavioral conjectures to our standard and basic predictions by relaxing some of our assumptions. Our first conjecture concerns the efficiency of whistleblowing programs. We conjecture that individuals may be more likely to comply with taxation in peer reporting treatment. Indeed previous experimental studies have shown that cooperation is significantly improved in the context of voluntary contribution mechanisms when individuals are allowed to punish their peers (Fehr and Gächter, 2000; Masclet et al., 2003; Noussair and Tucker, 2005; Carpenter, 2007; Bochet et al., 2006; Nikiforakis, 2010). Our conjecture summarized in conjecture 1:

Conjecture 1. *We expect less tax evasion in the peer-reporting treatment than in the baseline treatment.*

Our second conjecture concerns the factors behind the willingness to report others despite the absence of monetary incentives. Precisely, we argue that there may exist at least two main drivers behind the willingness to report tax evaders. One the one hand, individuals may be willing to report to the central authority those who do not comply with the law, i.e., by not reporting their full income. On the other hand, individuals may be also willing to punish those who break the informal norm within the group, i.e. for instance, by declaring less than average declaration rate of the group. We have previous empirical evidence that individuals do not hesitate to sanction free-riders despite any direct monetary benefits from doing so in different contexts such as the context of a voluntary

contribution mechanism.[26] However, motivations behind peer reporting are undoubtedly more complicated than peer sanctioning mechanisms. Indeed, while individuals may be willing to punish those who deviate from the social norm, they may be more reluctant to report them to a central authority due to the existence of social norms that prohibit tale-telling. In general, society does not welcome peer reporters as it breaks the social norm of loyalty Greenberger et al. 1987; Trevino and Victor, 1992). As group loyalty is an important social norm, the group may prefer to handle misconduct themselves rather than via peer reporting (Greenberger et al. 1987).[27] Some studies have shed light on the existence of such social norms of loyalty that prohibits denunciations and lead to the prescription of severe consequences for tattlers, such as ostracism.[28] Consequently, while individuals may have a strong desire to punish cheaters, the norm of loyalty may refrain them to report cheaters to the central authority. Thus, in the absence of monetary rewards, individuals will report tax evaders only if the desire to punish lawbreakers and those who deviate the social norm outweigh the psychic cost of breaking the group norm of loyalty. Our conjecture summarized in conjecture 2:

Conjecture 2. *a) Individuals may be willing to punish those who do not comply with the law as well as those who deviate from the social norm within the peer group. b) Whistleblower programs will be effective only if the willingness to punish evaders exceeds the moral cost of peer reporting, coupled with the cost of future retaliation.*

[26] Two non-strategic motives are typically evoked in the literature to explain why subjects may be willing to costly punish their peers. A first non-strategic motive relies on the fact that people react to unfair intentions by sacrificing a part of their payoffs to punish others, even when there are no gains from doing so (Rabin, 1993; Falk and Fischbacher, 1999). A second non-strategic reason to punish group members relies on distributional concerns such as inequality aversion (Fehr and Schmidt 1999). Precisely, individuals with distributional concerns who suffer from disadvantageous inequality may be willing to pay to punish defectors for reducing earnings inequality if the cost they bear is smaller than the impact of sanctions on the target's payoff.

[27] Those who deviate from the loyalty norm by reporting their peers may for instance suffer from retaliation including physical and verbal harassment from not only the denounced members but also the remaining group members (Greenberger et al., 1987).For instance, using a questionnaire on whistleblowers in private industry, Soeken (1987) reports that some peer reporters experienced retaliation which they attributed to their whistleblowing including harassment and abuse from superiors and peers.

[28] According to several authors, such norms of loyalty may well increase the survival chances of cooperative groups.

Our third conjecture concerns the effect of monitoring of others. Many contributions have emphasized that information can have an impact on agents' decisions. The mere fact of being observed by others may be sufficient to incite individuals to fraud less: this observability brings a form of moral disapproval that may lead individuals to comply with taxation to avoid shame. Coricelli et al. (2010) found that an auditing policy that aims to shame tax evaders by publishing pictures of them reduces tax fraud significantly. However, this may be partly counterbalanced by another effect, namely the fact that observing other cheating may induce mimicry. Some individuals may then decide to evade taxes more if they see others cheating profusely (e.g., Fortin et al., 2007). This is consistent with honesty being weak in the sense that it may be influenced by the observed decisions of others (e.g., Figuieres et al., 2013).[29] As Alm et al. (1995) indicate, low compliance rates in Spain might reflect the perception that the social norm is to evade rather than to pay taxes. The observation of a strong adverse effect here might then call into question the usefulness of providing taxpayers with information about the tax-evasion rates, in particular, if these are high. The net effect is unclear and is probably a function of the proportion of tax evaders in the initial period. Our conjecture here is summarized below.

Conjecture 3. *We should observe less tax evasion in the monitoring treatment compared to the baseline if the "shaming" effect dominates the "mimicry" effect.*

Our final conjecture concerns how information regarding the use of tax revenues affects peer reporting decisions. One may reasonably argue that the purchase of carbon credits with taxes would provide agents with an additional incentive to declare a higher proportion of their income to the tax authority to reflect the utility from contributing to a healthier environment. Indeed previous studies have shown that compliance increases

[29] In this model, agents' decisions to behave honestly depend on two dimensions: a "moral ideal" and the observed decisions of others. The first captures the ideal, or "ethical," level of honesty that can be grounded in a Kantian categorical imperative or an unconditional commitment to a contribution (Laffont 1975, Harsanyi 1980). The second captures social influence.

when taxes are targeted to fund a public good (i.e., Alm et al.,1992).[30] Consequently, one may expect more tax compliance in the baseline with carbon credits compared to the baseline without carbon credits. In the peer-reporting treatment with the purchase of carbon credits, we also expect higher willingness to punish those who fraud as it becomes more salient that they induce a social cost to society. This may be the case if peer-reporting participants appreciate the benefits of a better environment. We thus may also conjecture that those who put a greater value on the environment will have both less incentive to evade taxes and more incentive to report tax evaders. Our fourth conjecture is summarized below.

Conjecture 4. *We should observe lower tax evasion in the tax carbon baseline treatment compared to the baseline with no carbon credit. b) There should be more peers reporting of cheaters in the peer-reporting carbon credit treatment compared to peer reporting with no carbon credit.*

4. The experimental results

4.1. The determinants of tax compliance

Table 2 provides descriptive statistics on gross income, declaration rates, and taxes collected in each treatment. Our data indicate that declaration rates in all treatments are significantly above the theoretical prediction of a zero tax-declaration rate. This finding is consistent with previous work, indicating that a non-negligible part of participants behaves honestly. Table 2 also indicates some differences across treatments. Peer reporting significantly increases declaration rates, both with and without the carbon credit. The differences in declaration rates between the Baseline treatment without carbon credits (mean: 74.7, SD=33.5) and the Peer reporting treatment without carbon credits (mean: 90.6, SD=19.4), as well as that between the Baseline treatment with carbon credits (mean: 74.5, SD=35.1) and the Peer Reporting treatment with carbon credits

[30] In the same vein, in Cowell and Gordon's (1988) equity model, economic agents receive utility from both their incomes and the public goods they receive. The central prediction of this model is that a change in the tax rate has a non-negligible impact on the provision of the public good and that this indirectly affects the tax evader's decision.

(mean: 90.3, SD=20.7), are significant (p=0.0039, z=2.88, and p=0.0065, z=2.72, respectively; see Table 3). The average declaration rate in the monitoring treatment without carbon credit treatment (mean; 72.9, SD= 35.7) is lower compared to the baseline treatment without carbon credits (mean: 74.7, SD=33.5). Similarly, the declaration rate in the monitoring treatment with carbon credits (mean: 72.9, SD= 35.7) is also below the baseline with carbon credits (mean: 74.5, SD=35.1). However, these differences are not statistically significant (p=0.6310, z=-0.48, and p=0.33, z=-0.96). Table 3 also indicates that there are no significant differences between the treatments with and without carbon credits.

Our data also indicate fewer cases of null declaration in the treatments with reporting compared to other treatments. These treatments also have a greater proportion of decisions where all income is declared. Regarding the taxes collected, Table 2 indicates that these are of the order of 17 EMU for most treatments and rise to 22 EMU under peer reporting. This 30% difference is statistically significant (t-test) at the 1% significance level.

[Tables 2 and 3: about here]

Figures 1 and 2 show the trends in declaration rates over time for the baseline, monitoring, and peer-reporting treatments with and without carbon credits. Figures 1 and 2 corroborate the previous observations from Tables 2 and 3. These figures indicate that declaration rates are higher in the peer-reporting treatments than in the other treatments. Furthermore, the stability of the declaration rates in the treatment with peer reporting contrasts sharply with the downward trend in the other treatments, especially that with monitoring.[31]

[31] It is interesting to look at individuals' different strategies and their evolution over time. With six treatments and 432 individuals playing 20 periods, it is cumbersome to describe these using traditional graphics. For this purpose, we have developed a web application allowing the visualization of individual behavior by treatment in a compact way (aggregating with and without carbon credits) over 20 periods. The results are available at http://fiscalfrauds.cirano.qc.ca. This program was developed in collaboration with Lisa Di Jorio of Silkan solutions Inc. Silkan is a company that designs and develops high-performance simulations: www.silkan.com. Two results stand out: i) tax compliance in the peer-reporting treatments is

[Figures1 and 2: about here]

Our findings are summarized in result 1.

Result 1. *a) The average declaration rate is significantly higher in the peer reporting treatments compared to other treatments. b) Declaration rates are not significantly different in the treatments with and without carbon credits. c) Average declaration rates in the monitoring treatments are weakly lower than in the baseline treatment.*

Support for Result 1: Table 4 shows our estimation results for the determinants of declaration rates. We use Tobit panel models with random effects to control for the panel dimension of our data (individuals make 20 decisions in each treatment in which they participate). Our use of Tobit models is justified by the high percentage of censored observations. In column (1), we report estimates of a random effect Tobit model controlling only for treatment variables. Column (2) includes interaction terms (treatment*credit carbon condition); column (3) controls for the trend variable. Column (4) adds covariates to test the robustness of the treatment effects after controlling for demographics and experimental site (dummy variable 1: Quebec, 0 France). In column (5), we control for gross income, the fact of being audited in the previous period (audit t-1) and others' mean declaration rate in t-1. Column (6) adds self-report declarations regarding politics, religion, environment, work, and taxation. Finally, column (7) adds interaction terms period*treatment, which allows us to test whether the observed dynamics in Figures 1 and 2, i.e., whether the observed stability of the declaration rates in the treatment with peer reporting which contrasts with the downward trend in the other treatments is statistically significant.

greater than in the other treatments; and ii) many participants oscillate between all or nothing strategies in reporting their income, particularly in the baseline and monitoring treatments. We can also follow the reactions of the participants who had to pay a fine for more than one period (red dots), suggesting a considerable frequency of delinquency, or who were fined for only a single period (yellow dots).

[Table 4: about here]

In all the specifications presented, the econometric results of Table 4 confirm the patterns observed in the descriptive statistics: the declaration rates are significantly higher in treatments with "peer reporting." The "monitoring" variable support a statistically significant (in almost all the estimates) negative coefficient, suggesting that the mimicry effect of observing cheaters is somewhat larger than the positive disciplinary effect associated with being observed. The "carbon credit" variable is never significant, indicating that individuals are not influenced by the specific information that tax revenue is used to fund an environmental public good. We do not observe a trend in the declaration rates, with one exception is for the cross-variable 'period*peer reporting' with a positive statistically coefficient estimate observed in column (7): over time, participants in the peer reporting treatment increase their declaration rate which is consistent with Figures 1 and 2. A possible explanation is that participants realize over time that the risk to be denounced is higher than initially expected.

Table 4 also indicates that an audit in the previous period reduces the declaration rate in the current period. This may be due to a "bomb-crater effect," i.e., the erroneous belief that having been checked in one period makes it less likely that one will be audited in the next. An alternative explanation may be that participants are prepared to assume more risk to recover the losses incurred during the audit (Kahneman and Tversky, 1991). It is also to be noted that, following a costly audit, the return to not declaring is higher (lower penalty) in the period after the audit as we exclude the possibility of being audited twice for the same period. , "We also observe that the declaration rates fall with income, which may be explained mechanically by the fact that in our experiment the expected audit rate is lower when the reported income is above the median declared income."

Interestingly we find that risk-averse participants are more likely to declare their taxable income. Table 4 also indicates that older participants, those whose French is their mother tongue, and females are also more likely to declare their income. Finally, those who self-report that paying one's taxes is a social obligation (tax morality) also declare more income.

4.2. The determinants of being reported

Peer reporting is not negligible as 89 out of 144 participants, or nearly 62 % of participants report their peers. Nearly 21 % of them report other participants more than ten times even though reporting a participant costs 2 EMU, and there is no reward for reporting tax evasion.

In this section, we focus our attention on the determinants of being reported by other group members. We distinguish here two main reasons to be punished as tax evaders. First, subjects may care about everyone following the laws, and thus, individuals may be punished by not reporting their full income. Second, individuals may be motivated by fairness and social norms, and thus, individuals may be punished if they declare less than the norm. We assume here that the norm within the group is the average declaration rate.

Table 5 reports the determinants of the probability being reported using random effect probit models to control for the panel dimension of our data. Standard errors are clustered at the group level. In column (1), the independent variables include the participant's declaration rate, a trend variable, and a dummy variable for the treatment "carbon credit." The results of the column (1) reveal that a high declaration rate reduces significantly the probability of being reported by other group members. The carbon credit variable is not significant, indicating the absence of concern for the environment in the willingness to punish cheaters. The trend variable is not significant. Column (2) aims at testing whether lawbreakers are punished by controlling for the fact that subject *i* has not declared her entire income. As expected, this variable is highly significant with a positive sign. Columns (3) and (4) control for the deviation from the social norm within the group with both positive and negative deviations from average declaration rate. The 'Absolute neg dev from average declaration rate' variable corresponds to the absolute value of this difference when subject i's declaration rate is below the average of others and takes a value of zero otherwise. The 'Pos dev from average declaration rate' variable is the difference between subject i's declaration rate and the average declaration rate of the others when the subject i's declaration rate is above the average; it takes a value of zero

otherwise. Column (3) indicates that the probability of being reported is strongly influenced by the fact of reporting less than others in the group. Controlling for breaking the law, the fact that deviating from the average declaration rate within the group remains highly significant highlights the importance of social norms.

[Table 5: about here]

Our findings are summarized in result 3:

Result 2. a) *The probability of being reported decreases with the declaration rate b) Both breaking the law and social norm is highly punished.*

5. Discussion and Conclusion

There are many examples in everyday life of people using peer-reporting platforms when they observe deviations from the law or social norms. A recent example of peer reporting is the “Me Too” international movement against sexual harassment that spread virally in October 2017. Another well-known example of peer reporting is the Amber Alert, originating in the United States in 1996 and currently used in different countries across the world that is designed to inform the general public quickly when a child has been kidnapped and is in danger so "the public [would be] additional eyes and ears of law enforcement." (source Wikipedia). In the environmental sector, the French online platform “signalement ambroisie” (http://www.signalement-ambroisie.fr/) allows the public to report cases of ragweed, which is notorious for causing allergic reactions in humans, specifically allergic rhinitis.

In this paper, we investigate reporting activities in the specific context of tax evasion. Precisely we ran a controlled laboratory experiment to check whether whistleblower programs reduce tax evasion.

We have four main findings.

First, our data indicate that peer reporting has a positive and significant effect on tax-compliance rates. In our experiment, tax collection in the peer-reporting treatment was 30% higher than in the other treatments.

Second, individuals do not hesitate to report tax evaders despite the absence of any material rewards and a financial cost suggesting that the willingness to punish evaders mostly outweighs the norm of loyalty and the associated fear of blind retaliation. Both lawbreakers and those who deviate from the average declaration rate are highly punished.

Third, monitoring has a weak negative effect on declaration rates. A possible explanation is that observing others cheating leads individuals to revise their ideal moral motivation and thus evade more.

Finally, while we would have expected declaration rates to increase when the taxes are specified to finance a global public good relative to the situation where their use is not specified, we find no evidence of this in any of the treatments.

Altogether, our findings indicate that whistleblowing programs are effective in enhancing declaration rates and may thus complement more conventional programs based on audit and penalties. As direct monitoring is costly, the probability of being audited may be relatively low.[32] The introduction of whistleblowing programs increases the probability of being detected by adding an element of ambiguity to the likelihood of being audited. These programs introduce an element of uncertainty (ambiguity) by not knowing the exact probability of being denounced. In this perspective, Snow and Warren (2005) develop a theoretical model showing that an increase in uncertainty about the probability of being audited increases (reduces) tax compliance for ambiguity-averse (ambiguity-loving) taxpayers. Furthermore, some contributions have shown that, although the audit rate may be low, what matters is not the audit rate per se but rather the perceived likelihood of being audited (Andreoni et al., 1998). The tax administration may benefit

[32] Kolm (1973) notes that an optimizing government should "hang tax evaders with probability zero." In Becker's (1968) model, the cost of deterrence is minimized by combining an infinitesimal probability of detection with very severe punishment.

from publicizing whistleblower programs to increase the perceived likelihood of an audit.[33]

Although there are several political implications of our study, we should be careful in extrapolating our findings. Our study has some limitations, and there are issues beyond the scope of this paper that should be addressed in future research.

One obstacle to the implementation of peer reporting programs that should be investigated in future research is the risk of false reporting for adverse personal reasons. This kind of false reporting may produce considerable verification costs for the tax administration: if everybody were to denounce everybody else, the actual enforcement probability would remain unchanged. Authorities need to take sufficient precautions to avoid such indirect negative effects by explicitly stating that false reporting will be strongly punished. Furthermore, it should be made clear that peer reporting is not an attempt to resolve personal problems. The American IRS peer-reporting program provides a good illustration of this precaution, stating that "the IRS is looking for solid information, not an "educated guess" or unsupported speculation. We are also looking for a significant Federal tax issue - this is not a program for resolving personal problems or disputes about a business relationship."[34] If these precautions are not taken, the remedy may do more harm than good.

Another issue for future research is to test whether our results hold after relaxing some of our assumptions. In particular, we assumed that individuals could perfectly and without costs, observe the declaration rate of other group members. In real life, this is not so simple as such information is not always easily available. It remains, however that in

[33] In a sense, our results are in line with Kleven et al. (2011), who concluded that given the cost of tax audits, resources would be better spent on third-party monitoring.

[34] These mechanisms may be detrimental if they lead to calumny or individuals reporting their peers for unethical reasons. A number of experimental contributions have underlined the importance of anti-social behaviors such as nastiness (Abbink and Sadrieh, 2009) and envy via the willingness to burn money (Zizzo, and Oswald, 2001; Zizzo, 2003).

many situations, individuals have privileged information about their peers due to their proximity. This may hold for individuals observing their neighborhood behaving unethically, an employee observing her employer evading taxes, and so forth. This is precisely for this reason that government agencies can implement whistleblower programs that pay informants.

Another restrictive hypothesis that may be relaxed in the future is the fact that peer reporting activities were anonymous. Indeed in our experiment, only blind retaliation was possible. Consequently, participants could not directly identify reporters, which may have reduced the cost of peer reporting activities. A possible extension of this work may consist of allowing the opportunity to observe individual peer-reporting activities. We may also relax the assumption concerning our definition of peers. Indeed, in our experiment, groups of peers were artificially built by matching together three participants, which may have alleviated the cost associated with reporting activities. One may reasonably argue that individuals may be more reluctant to denounce their "real" peers, (a family member, a friend or a relative) as it breaks the social norm of loyalty toward peers (e.g., Greenberger et al. 1987; Trevino and Victor, 1992). To check this, a possible extension of this work may consist of running the same experiment with groups of "real" peers.

Another issue that may be investigated in future research is the role played by the nature of the public good that is financed by tax revenue. In our experiment, we found no effect of the information concerning how tax revenue is used relative to the alternative of not specifying its use. In future research, it might be interesting to compare different types of public goods funded by tax revenue or private goods publicly financed (higher education, for example).

Another question for future research is to what extent rewards for whistleblowing increase the program's efficiency. In this current study, we deliberately ignored the possibility of rewarding reporters, as we focused on the non-monetary factors behind peer reporting, assuming that individuals are mainly motivated by the desire to punish evaders. However, in most cases, tax authorities pay money to those who blow the whistle on evaders. For instance, the IRS Whistleblower Office can award the whistleblower up to

30 percent of the additional tax, penalty, and other amounts it collects if the IRS uses the information provided by the whistleblower. How large should rewards be? Our data suggest that individuals are mainly motivated by personal reasons to inform the tax administration. So why should the government pay informants? Our findings imply that a priori the rewards for those who blow the whistle on taxpayers who underreport their tax liabilities do not need to be too high to make whistleblower program efficient as reporters appear motivated by non-monetary factors. It would be of interest to test whether rewards have a significant impact on tax evasion. Whether incentivized schemes are more efficient than non-incentivized schemes is a priori unclear. Indeed although monetary rewards may incite individuals to engage in more peers reporting, rewards may also crowd out the intrinsic motivation to punish fraudsters (Frey and Jegen, 2001). Butler et al. (2017), in their study of whistleblowing by employees, found that rewarding whistleblowers is broadly effective and that the crowding out of non-pecuniary motivations is a priori, not a big concern. Crowding out effects may exist, and it remains an empirical question to be addressed in future research.

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Figure 1: The declaration rate by treatment and period (without carbon credits)

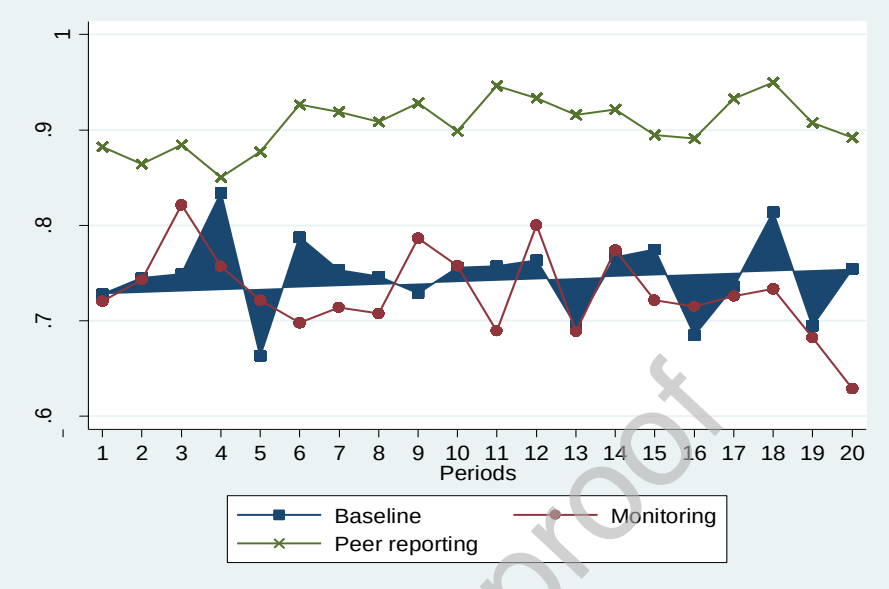

Figure 2: The declaration rate by treatment and period (with carbon credits)

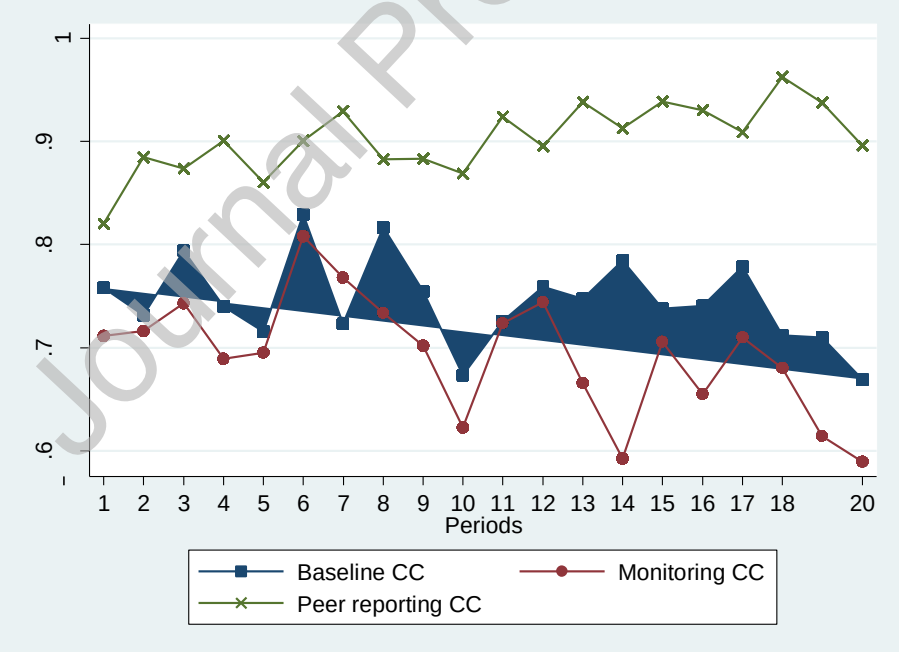

Table 1: The experimental design

Session Number	Number of Subjects	Treatment	Session Number	Number of Subjects	Treatment
1	12	Baseline no CC	19	12	Baseline with CC
2	12	Baseline no CC	20	12	Baseline with CC
3	12	Baseline no CC	21	12	Baseline with CC
4	12	Baseline no CC	22	12	Baseline with CC
5	12	Baseline no CC	23	12	Baseline with CC
6	12	Baseline no CC	24	12	Baseline with CC
7	12	Monitoring no CC	25	12	Monitoring with CC
8	12	Monitoring no CC	26	12	Monitoring with CC
9	12	Monitoring no CC	27	12	Monitoring with CC
10	12	Monitoring no CC	28	12	Monitoring with CC
11	12	Monitoring no CC	29	12	Monitoring with CC
12	12	Monitoring no CC	30	12	Monitoring with CC
13	12	Peer report no CC	31	12	Peer report with CC
14	12	Peer report no CC	32	12	Peer report with CC
15	12	Peer report no CC	33	12	Peer report with CC
16	12	Peer report no CC	34	12	Peer report with CC
17	12	Peer report no CC	35	12	Peer report with CC
18	12	Peer report no CC	36	12	Peer report with CC

Note: CC stands for carbon credits.

Table 2: Descriptive statistics on gross income, declaration rates and taxes collected

	Gross income				Declaration rate		Taxes collected before audit		No Income Declared	All Income Declared
	Obs.	Mean	Standard error	Median	Mean	Standard error	Mean	Standard error		
All observations	8640	60.61	23.48	61	78.72%	32.32%	18.75	10.79	6.38%	53.15%
Baseline without carbon credits	1440	61.51	22.81	61.5	74.65%	33.49%	17.79	10.29	7.15%	48.40%
Baseline with carbon credits	1440	59.78	22.88	61	74.50%	35.10%	17.56	10.99	5.49%	49.31%
Monitoring without carbon credits	1440	60.47	24.22	59.5	72.93%	35.70%	17.28	11.19	9.38%	46.53%
Monitoring with carbon credits	1440	61.78	22.69	61	69.35%	37.47%	16.67	11.15	13.75%	42.22%
Peer-reporting without carbon credits	1440	59.78	23.69	57.5	90.63%	19.40%	21.61	9.74	0.97%	66.53%
Peer-reporting with carbon credits	1440	60.34	24.51	61	90.25%	20.74%	21.61	10.12	1.53%	65.90%

Table 3: The Results of the Mann-Whitney Rank Sum Tests of Differences in Declaration Rates Between Treatments

	Without Carbon Credits		
	Baseline	Monitoring	Peer reporting
Baseline	___	Not Sig.	$p < .01$
Monitoring	___	___	$p < .01$
Peer reporting	___	___	___
	With Carbon Credits		
	Baseline CC	Monitoring CC	Peer report CC
Baseline CC	___	Not Sig.	$p < .01$
Monitoring CC	___	___	$p < .01$
Peer report CC	___	___	___
	Effect of Carbon Credits		
	Baseline	Monitoring	Peer reporting
Baseline CC	Not sig.	___	___
Monitoring CC	___	Not sig.	___
Peer report CC	___	___	Not sig.

Note: The table shows the confidence level at which the null hypothesis of no difference between the treatments can be rejected. The unit of observation is the average tax rate of the session over the entire session (yielding six observations per treatment).

Table 4: The determinants of declaration rates (Tobit panel models with random effects)

Dependent var : declaration rate	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Baseline	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Monitoring	-0.099*	-0.060	-0.099*	-0.082	-0.142**	-0.139**	-0.118*
	(0.056)	(0.079)	(0.056)	(0.054)	(0.067)	(0.067)	(0.068)
Peer reporting	0.406***	0.417***	0.406***	0.392***	0.347***	0.343***	0.313***
	(0.057)	(0.081)	(0.057)	(0.055)	(0.074)	(0.074)	(0.076)
Carbon credits	-0.021		-0.021	-0.022	-0.025	-0.028	-0.018
	(0.046)		(0.046)	(0.045)	(0.046)	(0.046)	(0.048)
Baseline * CC		0.012					
		(0.079)					
Monitoring * CC		-0.0649					
		(0.079)					
Peer reporting * CC		-0.097					
		(0.083)					
Period			0.0002	0.0002	-0.001	-0.001	
			(0.001)	(0.001)	(0.001)	(0.001)	
Period*Monitoring							-0.003
							(0.003)
Period*Peer reporting							0.006**
							(0.003)
Gross income (20 to 100 EMU)					-0.005***	-0.005***	-0.005***
					(0.0002)	(0.0002)	(0.0002)
$Audit_{t-1}$					-0.079***	-0.079***	-0.080***
					(0.016)	(0.016)	(0.016)
Others' mean declaration $rate_{t-1}$					0.078	0.078	0.071
					(0.054)	(0.054)	(0.054)
Risk aversion				0.176***	0.173***	0.179***	0.179***
				(0.046)	(0.047)	(0.047)	(0.047)
Age				0.010**	0.011***	0.010**	0.009**
				(0.004)	(0.004)	(0.004)	(0.004)
Language				0.118**	0.116**	0.130**	0.130**
				(0.058)	(0.059)	(0.059)	(0.059)
Female				0.113**	0.116**	0.101**	0.098**
				(0.046)	(0.047)	(0.048)	(0.048)
Tax morality						0.067**	0.069**
						(0.029)	(0.029)
Constant	0.998***	0.981***	0.996***	0.425***	0.728***	0.416***	0.379***
	(0.046)	(0.056)	(0.047)	(0.165)	(0.168)	(0.229)	(0.230)
Observations	8640	8640	8640	8640	8208	8208	8208
LL	-5774.71	-5774.46	-5774.69	-5775.96	-5339.65	-5339.65	-5339.65
Obs right-censored	4592	4592	4592	4592	4403	4403	4403
Obs left-censored	551	551	551	551	529	529	529

Notes: CC stands for carbon credits. The standard errors are in parentheses *** p < 0.01, ** p < 0.05, * p < 0.1. Risk aversion is a dummy for the sure option being chosen ($5 cash) in the Lottery; age is a dummy for the participant being over 31 years old; language is a dummy for the mother tongue being French; female is a dummy for the participant being a woman.The other control variables included in estimate (4) whose estimated coefficients are not statistically significant are dummies for having at least one university degree, having studied economics, the experiment being in Quebec, being a student, having already participated in an experiment. In estimates (6) and (7) tax morality variable comes from the answer to paying one's taxes is a social obligation (1 = strongly disagree – 5 = strongly agree). The other control variables included in estimates (6) and (7) whose estimated coefficients are not statistically significant include a dummy for trust in others, question regarding the importance of politics in life (1 = very unimportant – 4 = very important), religion being important (1 = very unimportant – 4 = very important); work is a social obligation (1 = strongly disagree – 5 = strongly agree), we should raise taxes to curb pollution (1 = strongly disagree – 5 = strongly agree) and global warming is a serious problem (1 = strongly disagree – 5 = strongly agree).

Table 5: The probability of being reported (panel RE probit)

Variables	(1)	(2)	(3)	(4)
Subject i' declaration rate	-3.020***	-2.128***		
	(0.600)	(0.541)		
Dum var. declare not all income		0.665***		0.890***
		(0.184)		(0.205)
Absolute neg. dev from average declaration rate			3.938***	3.010***
			(0.464)	(0.455)
Pos. dev from average declaration rate			0.027	2.480
			(1.465)	(1.465)
Average declaration rate			-0.569	1.734
			(1.058)	(1.264)
Carbon credits treatments	-0.125	-0.136	-0.092	-0.097
	(0.424)	(0.412)	(0.416)	(0.398)
Periods	0.001	0.003	0.003	0.0001
	(0.010)	(0.011)	(0.011)	(0.011)
Constant	1.497**	1.081**	1.081**	-3.177**
	(0.531)	(0.453)	(0.453)	(1.121)
Observations	2880	2880	2880	2880
LL	-1071.15	-1050.68	-1050.68	-1020.03

Notes: Standard errors clustered at the group level appear in parentheses *** p<0.01, ** p<0.05, * p<0.1.'Dum var : declare not all income variable'=1 if the participant did not declare all her income and 0 otherwise. Average declaration rate is the average declaration of the other group members. 'Absolute neg dev from average declaration rate' is the difference between subject i's declaration rate and the average declaration rate in absolute value if subject i's declaration rate is below average and takes zero otherwise, 'Pos dev from average declaration rate' is the difference between subject i's declaration rate and the average declaration rate if subject i's declaration rate is above average and takes zero otherwise .

Appendix A

Instructions: Treatment with peer reporting (with carbon credits)

You are invited to participate in an experiment in which you make a series of decisions. The experiment consists of several periods, in each of which you make a decision. You will be placed in a group with three other persons chosen at random from among the 12 participants in the experimental session. Throughout the 20 periods of the game, you remain in the same group of four individuals.

In any period all participants must take their turn before advancing to the next period. Your earnings depend on your decisions. Therefore, it is important to carefully read the instructions.

At the end of the experimental session, you will randomly draw one of the periods you played and your earnings for the session will be your "final net income" for this period.

Furthermore, taxes collected from all 12 participants during a given period, which will also draw at random from among the 20 periods, will be invested to purchase carbon credits to counteract greenhouse gas emissions.

The amount of money you win will be confidential. At the end of the experiment, you will be paid in private for the randomly selected decision period.

Progression of events

The computer issues you a total income in each period. This income will be randomly drawn by the computer from a value ranging between 20 and 100 EMU (experimental monetary units).

Payment of taxes

You are the only one to know your total income. When you know how much it is, you will be asked to declare your income to the government and taxes will be levied on the declared income. There is no restriction on the income you can declare (except that it must be non-negative and a whole number – no decimals).

When you have declared your income, you will be charged taxes at a rate of 40%.

Information about the other members of your group

When you have filed your income declaration, you will be told the declaration rate of each of the three other members of your group. In this situation, you have the option of informing on any participants as having under-reported their income. They will automatically be audited. Observe that each instance of reporting tax fraud costs 2 EMU.

Note: reporting tax fraud is anonymous. In other words, individuals who are audited will not know whether it is because they were reported or because they were selected in keeping with the probability of an audit.

We remind you that you will be in the same group for all 20 periods of the game.

Auditing of accounts

The government does not know exactly what your total income is. Only you have that information.

There are two possibilities:

- Case 1. You were not informed on by a member of your group. In this case, the government audits some accounts randomly. The government could audit your account and the accounts of all individuals in the room, and thus know your total income. However, this is very expensive and wasteful if you declared all your income. Therefore, the government audits certain accounts drawn at random. The probability of being audited is determined as follows:
    - If your declared income is in the bottom 50% of the incomes declared by the 12 participants, the probability of being audited is 20%.
    - If your declared income is among those that strictly exceed 50% of the incomes declared by the 12 participants, the probability of being audited is 10%.

- Case 2. You were reported by a member of your group. In this case, you will automatically be audited by the government.

In both cases, if an audit reveals that you under-declared your total income, you must pay (1) the back taxes on the undeclared income, and (2) a fine corresponding to 50% of those back taxes—for a total amount of 1.5 times the value of the evaded taxes.

Furthermore, you will automatically be audited for the two preceding periods. If you under-declared in either of those two periods, you will also pay 1.5 times the tax amount owing. Thus, for the period during which you were audited, your "final net income" will be equal to your total income – taxes paid on declared income – the sum of back taxes and fines for the current period (t) and the two previous periods (t – 1 and t – 2), if applicable, and the costs associated with reporting the members of your group, if applicable. Observe that you cannot be audited—and consequently fined—twice for the same period.

How are your earnings determined?

In each period, your "final net income" is calculated by the computer as follows:

- **If you are not audited:**

"Final net income" = Total income – Taxes on declared income – Cost of informing if applicable

- **If you are audited and have declared your total income:**

"Final net income" = Total income – Taxes on declared income – Cost of informing if applicable

- **If you are audited and have not declared your total income:**

"Final net income" = Total income – Taxes on declared income – Taxes on undeclared income (in t, t – 1, and t – 2) – Fines (in t, t – 1, and t – 2) – Cost of informing if applicable.

Since taxes on declared income are 40% of declared income, taxes on undeclared income (payable in the event of an audit) correspond to:

40 % × (total income – declared income). Finally, fines correspond to 50% of taxes on undeclared income. In other words, under these conditions, you pay 1.5 times the amount of the taxes you evaded (note that the program rounds decimals). We remind you that each time you inform on someone, it costs you 2 EMU.

At the end of the experimental session, you randomly select a number that corresponds to one of the periods played. Each number is equally likely to be picked. Your earnings in EMU for that period will be converted at the rate of 1 EMU = $0.40 CAN. Observe that any income that has been reduced below zero by fines will be set to zero. You cannot lose money in this game.

Furthermore, at the end of the experiment the taxes paid by all 12 participants during a given period, also drawn at random, will be invested in buying carbon credits online. The amounts paid in taxes in EMU will be converted at the rate of 1 EMU = $0.40 CAN, just like for your personal payment. We will buy these credits online at http://planetair.ca. One tonne of carbon offset of the type "Gold Standard carbon offset" costs approximately $40 and is the highest quality available (see http://www.cdmgoldstandard.org).

N.B.: You will receive an e-mail attestation to the purchase of carbon credits corresponding to the taxes raised.

Additional information

We encourage you to reread these instructions. After taking your seat at your computer, please raise your hand if you have any questions regarding these instructions. We will enquire about your question in private and then share the question and its answer with all participants. Questions must not be intended to validate a decisioOTn-making strategy, but rather to obtain a better understanding of the instructions.

Before beginning the experiment we will ask some questions regarding your age, sex, level and field of study, universities or schools currently attended, your labor market status, and whether you have already participated in this type of experiment. This information will remain anonymous. We are ready to start the experiment.

We will also ask you some questions to assess your understanding of these instructions.

Appendix B

Table B. Summary statistics

Variable	Definition	Mean	Sd. Dev.	Min	Max
Female (all)	Dum var :1:female/0: male	0.50	0.49	0	1
Baseline		0.55	0.49	0	1
Monitoring		0.45	0.49	0	1
Peer reporting		0.51	0.49	0	1
Credit carbone		0.47	0.49	0	1
No Credit C		0.53	0.49	0	1
Quebec		0.44	0.49	0	1
France		0.56	0.49	0	1
Age (all)	Age level	24.16	7.55	18	66
Baseline		23.98	7.34	18	66
Monitoring		23.94	7.24	18	59
Peer reporting		24.56	8.025	18	59
Credit carbone		24.11	7.72	18	66
No Credit C		24.21	7.36	18	59
Quebec		28.64	8.40	18	66
France		19.68	1.78	18	35
Undergraduate (Freshman year)	Education level, Dum var : 1 undergraduate 0 :otherwise	0.41	0.49	0	1
Baseline		0.42	0.49	0	1
Monitoring		0.38	0.48	0	1
Peer reporting		0.44	0.49	0	1
Credit carbone		0.39	0.48	0	1
No Credit C		0.44	0.49	0	1
Quebec		0.71	0.45	0	1
France		0.11	0.31	0	1
Economics	Field of study Dum var : 1 : economics, 0 otherwise	0.35	0.47	0	1
Baseline		0.36	0.48	0	1
Monitoring		0.41	0.49	0	1
Peer reporting		0.27	0.44	0	1
Credit carbone		0.32	0.47	0	1
No Credit C		0.36	0.48	0	1
Quebec		0.07	0.26	0	1
France		0.62	0.48	0	1
Mother tongue(French)	Mother tongue : dum var : 1 french, 0 otherwise	0.74	0.44	0	1
Baseline		0.73	0.44	0	1
Monitoring		0.73	0.44	0	1
Peer reporting		0.75	0.433	0	1
Credit carbone		0.75	0.43	0	1
No Credit C		0.71	0.45	0	1
Quebec		0.54	0.49	0	1
France		0.93	0.24	0	1
Risk aversion	Dum var : 1, safe 0 :risky lottery.	0.59	0.49	0	1
Baseline		0.58	0.49	0	1
Monitoring		0.55	0.49	0	1
Peer reporting		0.63	0.63	0	1
Credit carbone		0.58	0.49	0	1
No Credit C		0.59	0.49	0	1
Quebec		0.61	0.48	0	1
France		0.56	0.49	0	1
Politics	How important is politics in your life (1 = very unimportant – 4 = very important) ?	2.62	0.79	1	4
Baseline		2.64	0.77	1	4
Monitoring		2.58	0.77	1	4
Peer reporting		2.64	0.85	1	4
Credit carbone		2.69	0.82	1	4
No Credit C		2.55	0.77	1	4
Quebec		2.65	0.87	1	4

France		2.59	0.71	1	4
Religion	How important is religion in your life (1 = very unimportant – 4 = very important) ?	1.98	1.09	1	4
Baseline		1.89	1.05	1	4
Monitoring		2.04	0.77	1	4
Peer reporting		2.01	1.13	1	4
Credit carbone		2.05	1.13	1	4
No Credit C		1.91	1.05	1	4
Quebec		2.26	1.20	1	4
France		1.70	0.88	1	4
Trust	Do you trust in others? Dum var : 1 : yes, 0 no	0.30	0.45	0	1
Baseline		0.32	0.46	0	1
Monitoring		0.29	0.46	0	1
Peer reporting		0.29	0.45	0	1
Credit carbone		0.31	0.46	0	1
No Credit C		0.29	0.45	0	1
Quebec		0.36	0.48	0	1
France		0.24	0.43	0	1
Work	Is work a social obligation (1 = strongly disagree – 5 = strongly agree)?	3.66	1.03	1	5
Baseline		3.60	1.07	1	5
Monitoring		3.68	1.07	1	5
Peer reporting		3.68	1.02	1	5
Credit carbone		3.64	1.06	1	5
No Credit C		3.67	1.00	1	5
Quebec		3.83	0.99	1	5
France		3.48	1.04	1	5
Tax morality	Is paying one's taxes a social obligation (1 = strongly disagree – 5 = strongly agree)?	3.95	0.86	1	5
Baseline		3.97	0.79	1	5
Monitoring		3.91	0.92	1	5
Peer reporting		3.98	0.87	1	5
Credit carbone		3.97	0.87	1	5
No Credit C		3.93	0.85	1	5
Quebec		4.06	0.88	1	5
France		3.85	0.82	1	5
Tax to reduce Pollution	Shoul we should raise taxes to curb pollution (1 = strongly disagree – 5 = strongly agree) ?	3.38	1.12	1	5
Baseline		3.48	1.05	1	5
Monitoring		3.31	1.14	1	5
Peer reporting		3.36	1.16	1	5
Credit carbone		3.41	1.06	1	5
No Credit C		3.36	1.17	1	5
Quebec		3.52	1.18	1	5
France		3.25	1.03	1	5
Global warming	Is global warming a serious problem (1 = strongly disagree – 5 = strongly agree)?	4.24	0.98	1	5
Baseline		4.25	0.96	1	5
Monitoring		4.16	0.96	1	5
Peer reporting		4.30	0.75	1	5
Credit carbone		4.19	0.95	1	5
No Credit C		4.28	0.84	1	5
Quebec		4.32	0.90	1	5
France		4.14	0.88	1	5