

REVIEW

A PRACTICAL GUIDE TO SETTING UP YOUR TAX EVASION GAME¹

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Abstract

Over the last four decades, an important stream of literature has studied tax compliance behaviour in the laboratory through tax evasion games. In this review of over 70 papers, the main results are summarised, highlighting the most prominent features of tax evasion games. The results are interpreted in terms of laboratory tax compliance. Variables that have a positive impact on compliance are a non-student pool of subjects, a loaded frame, a directive way of asking for compliance, a progressive tax regime, redistribution of tax funds, endogenous audits, increased audit probability, larger fines and a one-off tax amnesty. Self-employed income and a complex tax system are expected to have a negative impact, while the impact of earned income, tax rates and public-good funds is unclear and deserves further investigation.

Keywords: tax evasion, tax evasion game, tax compliance game, laboratory experiment.
JEL classification: C9; H26.

INTRODUCTION

This year marks the 40th anniversary of the first ever tax evasion game (TEG), published by Friedland et al. (1978) in the *Journal of Public Economics*. This marked the beginning of behavioural public economics (also referred to as behavioural public finance), a discipline studying tax evasion and compliance in the laboratory.³ The problem of tax evasion was thus addressed quite early on, especially in experimental economics research. In comparison, the first versions of the Ultimatum and Dictator games, probably the best known and most played games in experimental economics, were not developed until 1982 and 1986 respectively (Güth et al., 1982; Kahneman et al., 1986). As noted by Torgler (2016), the number of laboratory experiments on tax has increased steadily since the 1990s, with an even more striking increase in field experiments.

There are three main reasons for the success of TEGs. First, as tax evasion deprives governments of resources, big interests are at stake in reducing it, and attention has focused on all possible ways of doing so, including experimental economics. Public administration has thus financed behavioural research to find solutions to fight tax evasion or simply provide more taxpayer-friendly services. Second, there is a need for observable and reliable data on tax evasion, since this kind of dishonest behaviour is by nature impossible or very complex to measure in the field (Muehlbacher & Kirchler, 2016). TEGs have been used as a substitute for field data. Selection bias in the available data makes it difficult to capture the bigger picture of

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³ Tax compliance is defined in the laboratory as declared income divided by full gross income. The tax compliance rate is subtracted from one to obtain the tax evasion rate.

tax evasion, given that field data can be drawn only from evaders who are caught. Laboratory experiments also allow causal inferences to be isolated, “whereas existing institutions are adopted endogenously” (Falk & Heckman, 2009, p. 536). For example, in real life, audit rates may be reinforced when evidence of increased criminal activity appears. Lastly, the laboratory allows many different hypotheses to be tested and the results observed directly in terms of compliance. Without tax experiments, this would be much more complex or impossible.

A TEG is an experiment in which participants are asked to declare a previously earned or endowed amount of money, knowing that it will be taxed at a certain rate. This mirrors income tax declarations, where tax administrations ask taxpayers to declare their previously earned income. Research on tax evasion has undergone various changes over the past 40 years since Friedland et al.’s (1978) seminal work. Their simple experiment has been enriched with many different variations, taking into account the pool of subjects, the framing of the experiment, the origin and nature of the income, the complexity of the laboratory tax system, the tax regime and tax rate, the subsequent use of collected taxes, audit probabilities and fines. This literature review aims to summarise the results on the most prominent variables from a wide range of published research using TEGs ($N \approx 140$). This will provide experimenters with a full picture of existing alternatives and their expected impacts on compliance. This is particularly important both because the field of research is booming and extending toward field experiments, and as a first step toward ensuring replication and comparability of experiments. This issue is receiving increasing attention, both in relation to TEGs (see e.g. Muehlbacher & Kirchler, 2016) and more generally in experimental economics (e.g. Camerer et al., 2016).

Relevant literature for the period 2013–2017 was collected through internet searches (Econlit, Google Scholar, Scopus, PsycINFO). Unless otherwise stated, only laboratory experiments with real monetary consequences were considered,⁴ and only experiments relating to TEGs were selected. Standard public-good games and market games were thus excluded from the survey, since the main tasks of these games are too different from that of TEGs.

This survey drew on previous work. Alm (1991) and Andreoni et al. (1998) were the first to include experiments in their literature reviews and put them into perspective with theoretical and empirical research. Torgler (2002) was the first to focus only on experimental methods to delineate a state-of-the-art for the discipline. Special mention should be made of Kirchler (2007), who has produced the most complete work on behavioural and psychological aspects of tax evasion, including many different empirical methods. Fonseca and Myles (2011) conducted an impressive survey of 27 laboratory experiments, offering a very clear, albeit unarticulated, summary of each, while Muehlbacher and Kirchler (2016) focused more on the external validity of tax experiments.

This literature review distinguishes between two types of variables for study: those with a positive impact on compliance and those with a negative impact. Variables with a positive or somewhat positive impact on compliance are a non-student pool of subjects, a loaded frame, a directive way of asking for compliance, a progressive tax regime, redistribution of tax funds, endogenous audits, audit probability, size of fines and tax amnesties. Variables with a negative impact on compliance are self-employed income and a complex tax system. The impact of the other variables is unclear and deserves further investigation. The paper concludes with recommendations on setting up TEGs, their external validity and the limitations of the present literature review.

⁴ Camerer and Talley (2007) show that incentivised and non-incentivised participants may sometimes behave differently.

TABLE 1: SUMMARY OF VARIABLES AND THEIR EXPECTED IMPACT ON COMPLIANCE

Variable	Impact on compliance
Professional pool of subjects	Positive
Loaded frame	Somewhat positive
Directive way of asking for compliance	Positive
Earned income	Ambiguous
Self-employed income	Negative
Complexity of the tax system	Negative
Progressiveness of tax regime	Positive
Tax rate	Ambiguous
Redistribution of tax funds to participants	Positive
Investment of tax funds in a public good	Ambiguous
Endogeneity of audits	Positive
Audit probability	Positive
Ambiguity of audits	Ambiguous
Size of fine	Positive
Amnesty	Somewhat positive

LITERATURE REVIEW

This literature review is organised in the chronological order in which experiments are generally conducted. A subject (whether a student or a professional) is invited to take part in a TEG. The TEG may be framed in a neutral or loaded way, and compliance may be sought in a directive or relaxed way. The subject's income may be given or earned, and may result from self-employment or a salaried job. The tax system may be more or less complex, and the tax regime proportionate or progressive. The subject learns about the tax rate, and that the collected taxes may be redistributed or given to an organisation. After a declaration, an audit may arise, varying by type, probability and level of ambiguity. If randomly selected, the subject may have to pay a fine, but may or may not benefit from a tax amnesty.

Students are a Valid Pool of Subjects

One criticism relating to the external validity of TEGs is that students are unrepresentative of taxpayers, as identified by Levitt and List (2007) in relation to flaws in experimental economics. Students have little or no experience of filing tax returns, and their social and demographic characteristics may differ from those of the taxpaying population (Alm et al., 2015). The results reviewed below show that students and non-students may indeed behave differently, with students being less compliant. However, student pools of subjects are valid because changes in students' behaviour go in the same direction as those for non students. Gërxhani and Schram's (2006) experiment, conducted in Albania and the Netherlands, engaged different pools of participants in playing a TEG: high-school students, university students, high-school teachers, non-academic university personnel and academic personnel. Their results show that tax evasion rates were higher for students than for teachers. Alm et al. (2015) ran a TEG experiment in which the participants were university students or university staff and faculty, using various parameters, including audit probability, information and benefits. The results show that levels of compliance differed between students and staff members. However, across the different treatments, compliance responses were the same for both pools of subjects. In Choo et al. (2015), 520 individuals played a framed TEG, involving 200 students with no prior experience of tax, 200 company employees who declared taxes directly through their company (third-party declaration) and 120 self-employed taxpayers who declared their own incomes. The experimenters tested different set of fines and audit probabilities, and found that there were indeed differences in compliance between groups, with students being the least

compliant, but removal of the tax framing from the experiment, i.e. making it a gamble, suppressed these differences. The enhanced compliance observed for non-student participants may have resulted from norms of compliance originating outside the laboratory.

Framing of the Experiment

The instructions given to participants may be tax-framed or neutral. A tax frame designates the use of words such as income, tax rate, audit, earnings, withholding rate and check. Compliance may be sought in a very directive or quite relaxed way.

Neutral or loaded frame

There is no automatic effect of context/framing overall, but it may have a joint effect with social and demographic variables, income source or income level. When a contextual effect exists, this almost always increases compliance. Once again, this effect may relate to social norms pushing toward greater compliance, for example where it is socially accepted that taxes should be paid.

Some experiments show that framing influences participants' behaviours. For example, Baldry (1986) studied behaviours in two experiments in which some participants played a framed TEG and others played an equivalent game (a gamble) that was not framed. The results show that the participants behaved differently: those in the framed experiment evaded less. Webley and Halstead (1986) made participants play a TEG presented as an "economic game" and debriefed them afterwards. Their initial results show that most subjects saw the experiment as a game, and that they would not have behaved in the same way in a real tax setting, so the authors ran another session in which the participants were told that they were participating in an "economic problem". In this session, the participants maximised their income more and underdeclared more. Wartick et al. (1999) also found that participants playing a TEG with framed instructions evaded less income, and that older subjects (25 and older) complied even more than younger subjects (under 25). This concurs with Mittone's (2006) comparison of a TEG and an equivalent gamble, where participants evaded less under tax framing.⁵ Trivedi and Chung (2006) also reveal no difference between tax terminology and non-tax terminology in a TEG when income is low, although there is a contextual effect when incomes are medium or high: participants evade less under tax framing. Similarly, Choo et al. (2015) show that tax framing may be of some importance, especially for non-students, who evade less when the experiment is framed.

On the other hand, Alm et al. (1992) conclude that the use of neutral wording does not change behaviour in a TEG. Durham et al. (2014) also show that overall context does not matter in tax evasion; however, it may have a joint effect with income source and income level, or with income source and time.

Ways of asking for compliance

The framing of a TEG also matters in terms of how participants are required to pay their taxes. The way of asking for compliance may induce participants to over- or under-report, so the instructions must be carefully designed.

⁵ Mittone's (2006) experiment differed slightly from the standard TEG. He asked participants to declare directly the amount of taxes that they wished to pay.

According to Cadsby et al. (2006, p. 944), many experiments communicate to participants that they “may report any amount of income from zero up to the amount they actually earned or received”, which may be interpreted as a subtle invitation to gamble. To investigate this effect, Cadsby et al. (2006) ran a non-framed experiment in which they underlined the importance of declaring the full amount of income earned. In almost all of their treatments, a huge majority of subjects chose to report 100 per cent of their income.

The Origin and Nature of Income

Income may be given to the participants or earned by the participants themselves. Earned income is usually implemented through a real task or, less often, using hypothetical effort (i.e. making participants believe that there is a strong selection process and that they are the very best). It is supposed that effort invested in earning an income will make participants less willing to be taxed, thus decreasing tax compliance (through the sunk cost effect or simply a notion of property). However, the reverse effect may also be hypothesised: effort invested may also increase risk-averse decisions because participants will not wish to risk their hard-earned income (reverse sunk cost effect). See Durham et al. (2014) for more on these effects. The nature of income, whether derived from a third party or from self-employment, implies a difference in the probability of detection, since income from self-employed workers is self-declared. This informs taxpayers' intentions.

Origin of income: earned or windfall income

There are no clear results for the effect of the origin of income on tax compliance decisions. First, few experiments have investigated the origin of income through TEGs. Second, there may be interaction effects with audit probability, tax rate, context, income level or period, gender, and hypothetical versus real effort. More research is needed to understand how these parameters interact.

In the existing literature, some experiments compare earned and endowed amounts of money. One framed TEG (Boylan & Sprinkle, 2001) shows that people who earned money (through one hour of algebra exercises) evaded as much tax as those endowed with money. However, when the tax rate increased, participants with earned income increased their compliance, whereas participants with endowed income decreased their compliance. In Boylan's (2010) experiment, participants in a neutral TEG were either endowed with income or earned an income (through 30 minutes of algebra exercises). The results show that compliance was higher for participants earning an income in the first rounds before an audit. In successive rounds, the compliance of participants with earned money decreased, while the reverse was true for those with endowed money. After an audit, these behaviours became even more polarised. Durham et al. (2014) required some participants to participate in a double auction market at the beginning of each round to earn an income, while others were randomly given the same incomes. The results show that origin of income had no overall impact on tax evasion. However, it had a negative impact in interaction with the period, and with income level and context. Peliova (2015) set up a non-incentivised TEG with windfall and earned income, and observed less declared income in the former case (36.77%) than in the latter (31.93%). An interesting result was that participants' gender was an obvious factor. Men (women) declared 10.72% (47.50%) of their windfall income and 26.92% (37.25%) of their earned income.

Other studies feature different levels of difficulty in earning an income and compare it to endowed income. Kirchler et al.'s (2009) framed TEG used three hypothetical effort levels (no

effort, low effort and high effort). In their first and second experiments, participants in the low-effort condition evaded more income than the others on average. In Bühren and Kundt's (2013) study, participants earned money through high effort (difficult and lengthy counting of ones and zeros in matrices), moderate effort (easier and shorter task) or no effort (windfall endowment). The results prove that moderate-effort income is less likely to lead to evasion than high-effort or endowed income.

Nature of income: self-employed or salaried job

After deciding whether the subjects of a TEG earn or are endowed with an income, experimenters may also ask them to choose between an income where they have an opportunity to cheat (self-employed) and one where they cannot (salaried), so as to reveal participants' preferences. The results show that when income comes from a salaried job and there is a 100 per cent chance of being audited, participants declare their income more truthfully than when they have a self-employed income. Self-employed income is popular: participants often choose it when it is available. As this type of income is expected to be lower when fully taxed, it reveals some intentions to cheat; however, it does not lead automatically to more evasion. Thus, people like to keep their opportunities to cheat open, but do not automatically use them.

In Gërxhani and Schram's (2006) experiment, participants first chose between unregistered (self-employed) and registered (salaried) income. They then drew an income randomly within one of these sets. Registered income had a high average and low standard deviation, and unregistered income had a lower average and higher standard deviation. Registered income was guaranteed to be audited, and unregistered incomes were audited with probabilities of zero, 16.67 or 50 per cent. The results show that participants who chose a registered income declared their income truthfully. Participants more often chose an unregistered income when tax evasion was possible. However, none of the participants who chose an unregistered income cheated. In Alm et al. (2009), participants earned a mixture of "matched" and "non-matched" income. The probability of detecting matched income was 100 per cent, whereas the probability of detecting non-matched income varied across treatments between 25 and 75 per cent. Thus, non-matched income was derived from self-employment. Overall, the subjects did not declare all of their non-matched income. No connection could be made between the percentage of income received as non-matched income and compliance. There was a slight downward trend, but compliance was highest when participants received half of their income as non-matched income. Elaborating on Gërxhani and Schram's (2006) experiment, Lefebvre et al. (2015) decided to make participants choose between registered or unregistered income. A lottery determined the amount of gross income effectively perceived by the participant across a set of possible incomes. Unregistered income had the highest standard deviation, and registered income the lowest. Registered income was automatically taxed, whereas participants with unregistered income had first to choose whether or not to report it, and then to decide the amount to report. The results show that 60.64 per cent of participants chose unregistered income, of whom 40.65 per cent chose to evade a portion of that income.

The More Complex the Tax System, the More Evasion?

The complexity involved in declaring income affects participants' compliance. Compliance increases when it is easier, for example when the tax administration provides a liability information service. The impact of uncertainty about the true tax liability is negative.

The complexity of the tax system set in the laboratory matters. Beer et al. (2016) set up a TEG with two conditions: one in which computation of the true amount of money to deduct was

easy, and one in which it was difficult. The results show that when computations are complex, participants choose the right amount and report more income than necessary. In contrast, when the tax administration makes an effort to simplify the tax system, compliance is improved. In Alm et al.'s (2010) experiment, under one condition the tax system was complex (with a deduction and a tax credit on low income), and in a second condition the tax administration could automatically compute the true tax liability and furnish it to participants. The results show that when the tax system is complex, compliance decreases compared with a baseline, and when the tax administration provides an information service, compliance increases. The same result is replicated by Vossler and McKee (2017) and McKee et al. (2017).

Another way to implement a difficult tax reporting system is to introduce uncertainty into the TEG. For example, Beck et al. (1991) set up a TEG in which the level of net income was unknown to the participants. They completed various reports, one of which was randomly drawn. The results show that uncertainty interacts with the likelihood of being audited and the level of fines, but seems to increase compliance. This is contrary to Vossler and McKee's (2017) and McKee et al.'s (2017) findings, where making the tax liability uncertain increased evasion compared with a baseline where the tax liability was certain.

Tax Regime and Tax Rate

The tax rate determines the proportion of subjects' earnings that the experimenters demand back after the participants have earned or received their incomes. The impact of the tax rate has been theoretically discussed. In their original paper, Allingham and Sandmo (1972) demonstrate that the tax rate has an ambiguous impact on tax evasion. The first effect is that when the tax rate increases, the tax debt liability also increases, making taxpayers less willing to comply. The second effect is that when the tax rate increases, income decreases. When taxpayers become poorer, they are more risk averse overall, and will therefore declare less tax. This ambiguity is solved by Yitzhaki (1974), who shows that, counter-intuitively, when the imposed penalty is applied to evaded taxes (rather than evaded income), increasing the tax rate induces more tax compliance. However, Bernasconi et al. (2014) modelled taxpayers with reference-dependent preferences and ethical concerns to show that, contrary to previous models, an increase in tax rate may also decrease tax compliance. The papers reviewed here concern compliance behaviours under varying tax regimes and tax rates.

Progressive tax regimes tend to deter evasion

A tax regime in which taxes are progressive rather than flat seems to be beneficial to tax compliance. However, taxpayers should not feel that they are being treated unfairly by the tax system.

A few experimental papers study the effect of tax rate regimes on tax evasion, measuring the difference between progressive and flat tax rates (more articles study how the type of tax rate influences work supply, e.g. Masclet and Montmarquette, 2008). Heinemann and Kocher (2013) exposed participants to both types of tax regime. In the first 10 rounds, participants earned an income and were asked to declare it under the tax regime of their choice. In the following 10 rounds, the other tax regime was implemented. First, the results show that participants evaded more under a flat tax rate than under a progressive tax rate. Second, reforming from the progressive to the flat regime increased compliance, but the same pattern was not observed for the opposite reform. Third, participants' expressed preferences for one or other tax regime were driven mainly by monetary considerations. Fourth, reform losers tended

to evade more than reform winners. This last result may have been driven by a sense of unfairness: participants may have had an impression of being treated less fairly under the new tax regime than in the past. A quite similar effect was produced by Spicer and Becker (1980): when participants felt that they had been unfairly treated (the experimenters told them that the other participants had paid a lower tax rate), compliance decreased. On the other hand, when the perceived tax rate compared with others was to their advantage, participants increased their compliance.

Higher taxes, more evasion?

As in Allingham and Sandmo (1972), only TEGs using flat tax rates are mentioned here. Existing evidence is inconclusive, and the effect of tax rates on laboratory tax compliance is somewhat ambiguous. The papers can be separated between papers showing a negative effect of tax rates on compliance, and papers with reverse, mixed or no effects. Friedland et al. (1978) considered two tax rates: 25 and 50 per cent. When the tax rate was 25 per cent, the proportion of income declared was 87 per cent, and when the tax rate was around 50 per cent, the proportion of income declared fell to 66 per cent. In Baldry's (1987) study, an increase in the marginal tax rate also increased participants' evasion. Collins and Plumlee (1991), who set tax rates at 30 or 60 per cent, also found that when the tax rate was high, evasion was higher. In Alm et al.'s (1992c) experiment, the tax rates were 10, 30 and 50 per cent, leading to average compliance rates of 37.6, 33.2 and 20.0 per cent. Park and Hyun (2003) varied the tax rates in their TEG from 10 to 40 per cent, and their results show that increasing the tax rate had a significant negative impact on tax compliance. Alm et al. (2009) also varied the tax rate from 35 to 50 per cent, showing that this decreased compliance by 11.6 points. A very comprehensive study of tax rates was conducted by Bernasconi et al. (2014), who compared two tax rates (27% versus 38%) across different treatments, showing that higher tax rates indeed reduced compliance. Using tax rates of 10, 20 and 30 per cent, Duch and Solaz's (2015) baseline results show that high taxes did indeed deter compliance. Peliova (2015) ran a TEG in which tax rates varied from 10 to 40 per cent with increments of 10 per cent. With a 20 per cent audit rate, compliance decreased linearly from 62.83 to 45.83 per cent at the 30 per cent tax rate level, but did not decrease any further thereafter. With a five per cent audit rate, there was a U-shaped relationship between tax rates and evasion: compliance decreased from 45.86 at the 10 per cent tax rate to 22 per cent for tax rates of 20 and 30 per cent, and then increased to 29 per cent at the 40 per cent tax rate.

With regard to papers showing mixed or no effects of tax rates on compliance, Becker et al. (1987) used three tax rates (33.33, 50.00 and 66.66%) on earned income and found that participants who considered their tax burden to be high were less prone to decide to evade. There was no correlation between the amount of income evaded and the perceived tax burden. Beck et al.'s (1991) TEG was set up with two different tax rates (25 and 50%), but increasing the tax rate in this experiment did not lead to increased compliance. In Alm et al. (1995), tax rates varied between 10, 30 and 50 per cent. The results show that increasing the tax rate increased compliance, with compliance rates of 14, 24 and 31 per cent respectively. The results of Alm et al.'s (1999) pre-vote rounds show that the effects of tax rates on compliance were negligible, with 28 per cent compliance at the 20 per cent tax rate and 29 per cent compliance at the 50 per cent tax rate. Using tax rates of either 20 or 40 per cent, Boylan and Sprinkle (2001) show that when incomes were endowed, doubling the tax rate decreased declarations from 61.50 to 55.30 per cent, whereas when incomes were earned, doubling the tax rate increased declarations from 48 to 68.70 per cent. These results reveals no effects arising solely from the tax rate, but indicate interaction effects between the nature of the income and tax rates.

In varying the tax rate from five to 70 per cent, Fortin et al.'s (2007) results show a U-shaped relationship with compliance: higher tax rates decreased compliance up to a 39 per cent tax rate, but raised compliance thereafter.

In summary, the impact of tax rates on tax evasion is unclear. In a meta-analysis of 20 experimental articles, Blackwell (2007) shows that increasing the tax rate has a positive but non-significant impact on compliance. Andreoni et al. (1998, p.839) conclude that “the effect of tax rates on evasion remains unclear” and “given the importance of this topic, it surely deserves further investigation”. In this literature review, which focuses only on flat tax rates, tax rates seem to deter compliance when they increase. However, a relatively large proportion of studies has found no, reverse or mixed effects. This tends to validate Allingham and Sandmo's (1972) finding for the effect of tax rates that there may be a U-shaped relationship between taxation and compliance. Below 30 per cent, an increase in the tax rate may decrease compliance. Beyond a 30 to 40 per cent tax rate, a kind of psychological threshold may be reached, leading to an increase in compliance when the tax rate is raised further. The size of fines is always specified in terms of evaded taxes, and losses from being fined may loom larger than gains in participants' minds beyond this threshold.

Use of Collected Taxes

When a tax rate is applied to income, it results in an amount of collected tax. This may be kept by the experimenter to reduce the cost of the experiment, and is thus considered by the taxpayers as forfeited (as in Fortin et al., 2007). However, it is more usually redistributed to participants, with or without a social multiplier – as a public-good game with a marginal per capita return – or donated to finance a real-life public good.

Redistribution to participants

There are two ways of using collected taxes in a TEG. The first is to redistribute collected taxes to participants. As proved by Blackwell (2007), redistribution has a strong positive impact on compliance, which increases with the size of the social multiplier. Numerous papers demonstrate this result, as reviewed below in chronological order.

Becker et al. (1987) shared out different proportions of the taxes collected (0.60, 1.20 and 1.80% in one condition, and 1.70, 3.40 and 5.10% in another). Their results show that the amount of public money received by participants impacted negatively on their decisions to evade tax. However, this relationship was not significant with regard to the amount of tax evaded. In Alm et al. (1992a), the compliance rate rose from 26.20 to 55.70 per cent when money was placed in a group fund, with a social multiplier of 2 and shared equally among the taxpayers, and with a similar treatment, Alm et al. (1992c) observed a rise in compliance from 33.20 to 37.40 per cent. Alm et al. (1992d) show that the higher the social multiplier of the fund, the higher the compliance rate. Their compliance rates were 43.50, 53.70 and 59.20 per cent with social multipliers of 0, 2 and 6 respectively. Increasing the social multiplier increased compliance, but at a decreasing rate. Alm et al. (1995) investigated both the impact of redistributing the tax fund and the composition of the group. In the first condition, the tax fund was redistributed for a certain number of rounds to a fixed group; in the second, the fund was redistributed to a group with membership turning over. In both conditions, the social multiplier was equal to 2, and these conditions were compared with others that had no tax fund. No differences were observed between the fixed or variable status of members of the group receiving the tax fund (compliance with fixed members 27.80%; compliance with variable

members 26.60%). The results also show that taxpayers in experimental sessions with a tax fund exhibited only marginally increased compliance (average of 25% in the control condition). Bosco and Mittone (1997) implemented a TEG in which taxes were partially redistributed, showing that without redistribution, 80 per cent of participants evaded, whereas with redistribution, this rate decreased to 46.70 per cent. The presence of redistribution decreased both the likelihood of deciding to evade and the amount of money evaded. In Alm et al. (1999d), when the social multiplier was 0.5, compliance was 14 per cent, and when the social multiplier increased to 2, compliance also increased, to 44 per cent. Park and Hyun (2003) set up a TEG in which in one condition the tax fund was redistributed to participants and in another was not. The results show that the presence of a public good had a significant negative impact on tax compliance. Using a social multiplier of 2, Torgler (2003) compared real taxpayers under two conditions, one with redistribution of the taxes collected and the other without. The results show that with redistribution, taxpayers increased their declarations from 57.5 to 85.0 per cent of their income. Gërxhani and Schram (2006) ran sessions with and without redistribution of the taxes collected to participants, with a social multiplier of 1, and their results show that with a public good, participants more often chose a registered income, but this did not significantly decrease overall tax evasion.

Public good fund

The second way of using collected taxes in a TEG is to use them to fund a real-life public good. There are various types of public good in which participants' taxes may be invested, such as donating to an organisation or institution, or funding a scholarship. The impact on compliance is not definitive in the literature. Moreover, it is still unknown whether donation or redistribution of taxes performs better. What is more certain is the direct effect of democracy in a TEG: when participants are able to choose the destination of the donation, compliance increases.

Mittone (2006) compared compliance rates under three conditions: (1) in the baseline condition, the money was burned, (2) people received the amount of tax collected back through redistribution (without no mention of any social multiplier), or (3) taxes were invested in a real-world public good (a scholarship). The compliance rates were 47.17, 60.28 and 72.28 per cent respectively. In contrast, Masclet et al.'s (2013) results reveal no differences between cases in which participants' taxes were invested in purchasing carbon offset credits to counter the greenhouse effect, and when participants' taxes were burned.

The choice of the real-life public good is also important. The more participants support the organisation that will receive the tax collected, the more they comply (Alm et al., 1993). Indeed, when students had to comply in order to support two alternative organisations – their favourite one (relating to student support) and their least favourite one (university support) – the favourite received more tax funding than the other. The results of several studies also show that being able to vote (or signal preference) on the preferred tax recipient increases compliance (Alm et al, 1993; Wahl et al., 2010; Lamberton et al., 2017). Alm et al. (1999) also show that participants vote according to their own interests with respect to the tax fund parameter. When the social multiplier is high, they vote in favour of a tax rate increase, and vice versa.

Doerrenberg's (2015) study is the only one to have investigated the differing effects on tax compliance of redistributing to participants or donating. The tax fund was either equally distributed between participants, invested in a research fund, donated to the Red Cross or transferred to the German federal budget, resulting in compliance rates of 30.22, 42.52, 40.87

and 34.94 per cent respectively. Although tax compliance was higher when money was donated for research or charity purposes, these differences were not significant.

Type, Probability and Ambiguity of Audit

In real life, the probability of being audited differs according to different types of taxpayer. Some taxpayers are audited strategically, not randomly. With regard to random audits, as the probability of being audited rises, fewer taxpayers will be willing to evade (Allingham and Sandmo, 1972). However, it has also been hypothesised that the probability of being audited need not be high to deter tax evasion: as stated in prospect theory, taxpayers may over-evaluate their chances of being audited, even with very low probability. Kahneman and Tversky (1979) were the first to shed light on this effect, and their results have since been updated and adapted to the tax framework (e.g. Dhimi and Al-Nowaihi, 2007). Ultimately, no one really knows the probability of being audited when cheating, so ambiguity may play an important role.

Endogenous audit is most effective

Audits may be either random or strategic. Strategic or endogenous audits mean that the tax administration targets a particular sub-sample of taxpayers. The endogenous audit mechanism may relate either to the relative behaviour of a taxpayer within a group, or solely to the compliance history of the particular taxpayer. The literature shows that endogenous audits always trigger more compliance than random audits.

The first mechanism studied here is when only taxpayers' compliance history influences their chances of being audited. Collins and Plumlee (1991) were the first to study endogenous audits. They compared a condition with a fixed probability of audit, a condition with a cut-off under which participants were audited with certainty, and a conditional audit where a preliminary earning task signalled which participants were supposedly the richest. The results show that the type of audit may have an impact on compliance. The type triggering the most evasion was random audits. Conditional audits produced a lower rate of evasion than the cut-off type, but this difference was not significant. Alm et al. (1992b) were the first to test a conditional audit probability reduction. When participants were audited and found to be fully compliant, the probability of being audited was reduced from 4.0 to 2.7 per cent, and then to 1.3 per cent. If participants were subsequently found to be non-compliant, the audit probability was again set to 4.0 per cent. Compared with random auditing, this audit reduction performed better in terms of compliance. Alm et al. (1993) also investigated these different types of audits: in one condition, they set random audits with fixed probabilities, and in the other conditions, audits were endogenous and dependent on taxpayers' actions. In one endogenous audit rule, people who were found to be non-compliant were certain to be audited within a specific period in the future (future audits). In another audit rule, people who were found to be non-compliant were certain to be audited for a specific period in the past (back audits). The last endogenous audit fixed a threshold under which taxpayers were certain to be audited. The results show first that endogenous audits always performed better than random audits in terms of compliance, even for a very high audit probability. The most effective endogenous audit rule was the threshold, probably because it involved a high number of audits. The least effective was the future audit rule. However, the endogenous audit rules did not take into account the cost of running the audits. Clark et al. (2004) sought to reach the best possible compliance outcome while also minimising the costs of auditing. In their framework, participants were first assigned to one of two pools of taxpayers, based on a first audit. The first was for somewhat compliant people, with a lower fine and probability of audit, and the second was for somewhat non-compliant

people, with a higher fine and probability of audit. Two mechanisms were thus studied: past-compliance targeting (PCT) and optimal targeting (OT). PCT depended on the audit results to move taxpayers from one pool to the other, whereas OT randomly transferred individuals between pools and used the audit results to allow compliant taxpayers to move from the second pool to the first. These treatments were compared with a classic random audit equivalent (RAE). The results show that, if a tax administration needs to minimise inspection rates, OT is the best strategy, whereas PCT is the best strategy to maximise compliance rates. Cason and Gangadharan (2006) ran a similar experiment with two pools of subjects: group 1 with a low fine and audit probability, and group 2 with a high fine and audit probability. Participants were first sorted randomly between groups, and then moved from one group to the other after the audit result. The results show that the evasion rate was higher in group 1 than in group 2, showing that evaders “behaved” in order to be moved to group 1.⁶

Another way of selecting which tax returns to audit is to target only returns that deviate too far from average reports. This means that an individual taxpayer’s chances of being audited vary with the declarations of other taxpayers. The TEG is thus transformed into a coordination game, where participants must coordinate to reach the best outcome for them, i.e. declaring zero. Alm and McKee (2004) placed participants into groups of five, and a cut-off determined the deviation above which an audit was run (with cut-offs being varied across conditions). This was compared with a random audit condition, and a cut-off condition with “cheap talk”, where subjects were allowed to discuss their strategies amongst themselves. The results show that participants had trouble coordinating to make the lowest declaration, so this kind of strategic audit was effective. The only exception was when cheap talk was possible between participants. Overall, the higher the cut-off, the more difficult it was to coordinate. A simpler coordination environment was employed by Dai (2016), who placed participants in groups of three, with an audit probability of 20 per cent as a baseline. However, when an audit occurred and two out of three participants were found to be non-compliant (i.e. declaring less than 100% of their income), the audit probability was raised to 90 per cent (known as a “crackdown” period). This crackdown lasted until all group members were found to be compliant. In this study, the timing of the announcement of the audit rate also varied (before or after filing, or with no announcement). The results show that participants reacted quickly when crackdowns were endogenous, and succeeded in coordinating on the 100 per cent declaration using strategic interdependence. Compliance rates rose from 40.54 to 83.14 per cent in the no announcement condition, from 58.61 to 84.90 per cent in the pre-announcement condition, and from 56.33 to 75.78 per cent in the post-announcement condition. The impact of pre- or post-announcements of audit probability increases did not differ significantly. Kamiyo et al.’s (2017) experiment had one random audit treatment, two cut-off audit treatments (with two different levels of cut-off) and one lower-reported-income audit (LIRA) where the lowest income of a group of four subjects was audited. The results show that all the endogenous audits performed better than the random one, but all endogenous audit rules had the same effect.

Audits deter evasion

⁶ In Clark et al. (2004) and Cason and Gangadharan (2006), subjects faced only two decisions: being compliant (declaring 100%), or not and incurring a cost c , thus differing from a standard TEG.

Most TEGs use random audits, as in Allingham and Sandmo's (1972) model. Audits have a strong positive impact on laboratory tax compliance.⁷ As before, papers revealing a strong positive effect of audits are reviewed first.

In Friedland's (1982) study, audit probability varied from 23 to 54 per cent, leading to compliance rates of 71.11 and 94.67 respectively. In Spicer and Hero (1985), the number of random prior audits in the first nine rounds of a TEG significantly reduced taxes evaded in the 10th round. Webley (1987) set up a TEG in which participants faced two audit probabilities, 16.67 and 50.00 per cent, producing compliance rates of 78.52 per cent for the lower audit probability and 85.68 per cent for the higher. Beck et al. (1991) implemented an experiment dealing with uncertainty, in which participants faced a 40, 50 or 90 per cent chance of being audited. The results show that when the audit probability increased, participants declared more income. Alm et al. (1992d) increased the audit probability from zero to two per cent, and then to 10 per cent, producing compliance rates of 20.00, 50.30 and 67.50 per cent respectively (in a condition with neutral instructions similar to the condition with framed instructions). In Alm et al. (1995), audit probabilities varied between five, 30 and 60 per cent, with the fines varying between one, two and four per cent of unpaid taxes. Except when the fine was equal to one, the results show that raising audit rates significantly increased compliance. Alm et al. (1999) set up a TEG where, all else being equal, the audit probability increased from two to ten to 50 per cent, and the compliance rates varied from 23 to 39 to 73 per cent respectively. Park and Hyun's (2003) TEG had differing audit probabilities of six, 10 and 15 per cent. The results show that audit probability significantly increased tax compliance: when the former increased by one per cent, the latter increased by almost 1.6 per cent. Kirchler et al. (2003) introduced audit probabilities of either 15 or 30 per cent in each period, showing that increasing audit probability increased compliance. In Alm et al. (2009), where the audit probability could be either 10 or 30 per cent, the results reveal a significant negative impact of audit probability on tax evasion. When audit probability was raised by 20 points, compliance increased by 4.9 per cent, *ceteris paribus*. Cummings et al. (2009) ran two TEGs with varying audit probabilities in South Africa and Botswana. When the fine was equal to 1.5 times the amount evaded, a rise in audit probability from 10 to 30 per cent increased compliance in South Africa (49.40% to 56.90%) but decreased it in Botswana (61.70% to 41.80%). When the fine was equal to three times the amount evaded, a steady increase of 10 points from 10 to 40 per cent audit probability led to increasing compliance in both countries (from 48.50% to 69.74% in South Africa and from 62.20% to 74.99% in Botswana). When Peliova (2015) increased the probability of audit from five to 20 per cent, compliance also increased for any level of tax rate.

Fewer studies have found mixed or no effects of audit probability on compliance. Friedland et al. (1978) studied the difference between more frequent audits coupled with lower fines, and fewer audits coupled with larger fines. When the probability of being audited was 6.67 per cent and the fine was 15 times the amount evaded, compliance amounted to 87.40 per cent of income. When the probability was 33 per cent and the fine three times the amount evaded, compliance was only 79.60 per cent. In this case, increasing the probability of being audited does not seem to have had a strong impact, probably because it was accompanied by a lower fine. Alm et al. (1992c) set up a TEG with different audit rates of two, four and six per cent, all else being equal, with compliance results of 32.10, 33.20 and 36.50 per cent respectively. Compliance did indeed increase with audit probability, but in a non-linear and non-significant

⁷ Although the average effect of an audit is to increase compliance, some researchers observe that audits may also backfire: the audited taxpayers may wrongly believe that they cannot be audited again, leading to a decrease in compliance (see e.g. Mittone, 2006).

way. Choo et al. (2015) show that doubling the audit probability from 20 to 40 per cent had no significant impact on any of the three subject pools in their experiment.

In summary, audits are probably the least ambiguous variable available to encourage compliance. The existing literature shows that, all else being equal, increasing audit probability increases tax compliance. Few studies have found no or mixed results from increasing audit probability. Two meta-analyses support this result (Blackwell, 2007; Bloomquist, 2009).

Ambiguous impact of ambiguity

According to prospect theory, participants are supposed to over-evaluate their probability of being audited. So far, the results seem mixed. Indeed, the stronger the likelihood of being audited, the less participants evade. However, only one study in three provides evidence in line with the PT.

The effect of audit expectation plays a critical role. Becker et al. (1987) demonstrate that the more participants awaited a strong audit probability, the less they evaded. The only result in line with prospect theory was produced by Spicer and Thomas (1982), who implemented a TEG with three different rates of audit probability: five, 15 and 25 per cent. In the first condition, the experimenters communicated the precise rates to the subjects. In the second condition, they communicated the vague information that the audit probability was low, medium or high. In the third condition, participants were told nothing. The results show that when participants were certain of the audit probability, it impacted negatively and significantly on their likelihood of evading and the amounts evaded. When the information was vague, it impacted negatively on both components of evasion, but only the likelihood of evading was significant. When no information was given, no correlations were significant. In contrast, Friedland (1982) increased the audit probability from 23 to 54 per cent. When precise information was given, the compliance rates were 71.11 and 94.67 per cent respectively, and when the information was vague, compliance was higher for low audit probability (74.46%) but similar for high audit probability (94.73%). Thus, ambiguity seemed to be effective only for lower probability. Choo et al. (2015) also show that either telling participants directly that the audit probability was 20 per cent or making it ambiguous resulted in no difference, and hence no impact of ambiguity on compliance.

Fines and Amnesties

Fines are the second main deterrent policy variable. Theory logically predicts a positive correlation between fines and compliance (Allingham & Sandmo, 1972; Yitzhaki, 1974). Tax amnesties, where evasion is discovered but no fines are set, are also discussed below.

Fines deter evasion

As expected, when fines increase, laboratory tax compliance also increases. This is demonstrated in the literature reviewed chronologically in this section. Few studies have found mixed or no results for compliance. In Blackwell's (2007) study, the fine had a non-significant but positive impact on tax compliance.

In Friedland et al.'s (1978) experiment, frequent audits seemed to be less of a deterrent than significant fines. Friedland (1982) shows that when the fine was increased from three to seven times the tax evaded, compliance also increased, from 79.31 to 86.47 per cent when the audit probability was precisely described, and from 83.36 to 85.83 per cent when it was vague. In

Webley (1987), participants faced fines of both two and six times the tax evaded. The results show that in the lowest audit probability, compliance rates were about 77.47 per cent, with 86.72 per cent compliance for the highest probability. Beck et al. (1991) set up a TEG with two different fine levels: 1.2 times and twice the unpaid tax. Their results show that increasing the fine strongly decreased tax evasion. Collins and Plumlee (1991) chose the same two levels of fine, but although the lowest penalty triggered more evasion than the highest, the difference was not significant. Alm et al. (1992c) set up a TEG with fines of one, two and three times the unpaid tax, *ceteris paribus*. These fines led to compliance rates of 31.70, 33.20 and 37.60 per cent respectively, showing that increasing fines indeed increased compliance, but in a non-significant way. In Alm et al. (1999), when the penalty was equal to five times the evaded tax, compliance was 39 per cent, and when the penalty was 25 times the evaded tax, compliance jumped to 58 per cent. In Alm et al. (1995), fines varied between one, two and four times the unpaid tax, coupled with differing audit probability. There were no differences in the impact of fines when the audit probability was five per cent; however, at higher audit probability rates, when the fine size increased, compliance also rose. Park and Hyun's (2003) TEG had fines of one, three and five times the unpaid tax, and their results show that the size of the fine was significant in reducing tax evasion. In Kirchler et al. (2003), with fines of 0.5 and equal to the amount evaded, fine size tended to increase compliance, but in a non-significant way. The experiment featured in Cummings et al. (2009) also varied the fine size. When the audit probability was equal to 10 per cent and the fine was doubled from 1.5 to three times the evaded tax, compliance remained almost unchanged for South Africans (from 49.40% to 48.50%), but increased for Botswanans (from 61.70% to 62.20%). When the audit probability was 30 per cent, compliance in both countries increased (from 56.90% to 61.80% in South Africa and from 41.80% to 75.10% in Botswana). Choo et al. (2015) varied the fine rates between one and two times the unpaid tax. Doubling the fine had a positive and significant impact on the pool of students, but only a marginally significant one on workers.

A one-off amnesty tends to deter evasion

Two thirds of papers show that amnesties have a positive impact on post-amnesty compliance. However, it is important not to repeat an amnesty too often, nor to allow participants to anticipate one.

Alm et al. (1990) produced a complete experimental work on amnesties. In their experiment, participants who were caught cheating paid the evaded tax but did not pay any fine. However, after an amnesty, taxpayers evaded more. Believing that there would be an amnesty in one round of the TEG (whether or not it actually occurred) also reduced compliance. Even when the tax administration warned that it would be the only amnesty of the game, experiencing an amnesty still reduced compliance on average. The only way to ensure a higher level of compliance was to combine an amnesty with stronger deterrent variables (audit probability and fines). This combination outperformed increasing deterrent variables without an amnesty. Torgler and Schaltegger's (2005) two experiments, one in Costa Rica and the other in Switzerland, partly reproduced that of Alm et al. (1990). Some results were similar: it was indeed found that repeating a tax amnesty did not improve compliance, and that expectations of an amnesty were detrimental to compliance. However, contrary results were also found: a tax amnesty had a positive impact on tax compliance, especially for the Swiss groups, and the effect of an amnesty without the enforcement of deterrent variables was more powerful than the same effect with enforcement. Rechberger et al. (2010) also demonstrate that tax amnesties have a positive impact on tax compliance.

CONCLUSION

Table 1 summarises the expected impact of each variable on compliance. It shows that inviting professionals to play a TEG, a loaded frame, a directive way of asking for income declaration, a progressive tax regime, redistributing tax funds to participants, endogenous audits, increasing audit probability and fine sizes, and a single tax amnesty have a positive or somewhat positive impact on compliance. In contrast, granting participants self-employed income and complex tax systems have a negative impact. However, more research is needed to understand the impact of earned income, tax rates, public-good funds and audit ambiguity on compliance.

Some recommendations can be made for setting up a TEG. Experimenters should first ask what their main objectives are in terms of compliance and the extent to which a real-life setting is mirrored. There seems to be a trade-off between prompting enough evasion and mirroring real-life parameters. If a TEG sets a loaded frame, uses a directive way of asking for compliance and grants earned income, there is a risk of obtaining insufficient variability in evasion to correlate with a questionnaire or to observe the impact of a treatment aimed at improving compliance. Nonetheless, for the sake of replication and validity, Muehlbacher and Kirchler (2016) advise setting a loaded frame, redistributing tax funds, granting earned income and avoiding student pools as much as possible. However, they also advise against excessive standardisation of experimental research, as “heterogeneity [...] allows for replications in different settings” (p. 17).

Numerous topics have been left unaddressed in this review, such as social influence between taxpayers (Fortin et al., 2007), the impact of individual personality traits (Jacquemet et al., 2017b) and physiological measures (Coricelli et al., 2010; Dulleck et al., 2016), and the consequences of institutional changes (Jacquemet et al., 2017a). Each study has used its own set of variables, and this review has focused more on how to build a TEG. The issue of a TEG’s external validity has also not been addressed here, but Torgler (2002), Bloomquist (2009), Alm et al. (2015) and Muehlbacher and Kirchler (2016) have done so. When compared with the right data, Bloomquist (2009) and Alm et al. (2015) conclude that TEGs have rather good validity, although Muehlbacher and Kirchler (2016) warn about not “whispering in the ear of princes” before verifying “experimental findings by replication through other methods” (p. 17). Finally, although this review offers some clues as to the expected impact of some variables on compliance in the laboratory, it is not guaranteed that this effect will be confirmed (of the 15 variables reviewed, six are labelled as ambiguous or “somewhat” positive or negative). Confounding variables can always be suspected to have played a role, especially where few studies have been carried out. The only way to overcome this difficulty would be to run a meta-analysis on the existing set of databases used by all TEGs. This work is next on the author’s agenda.

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