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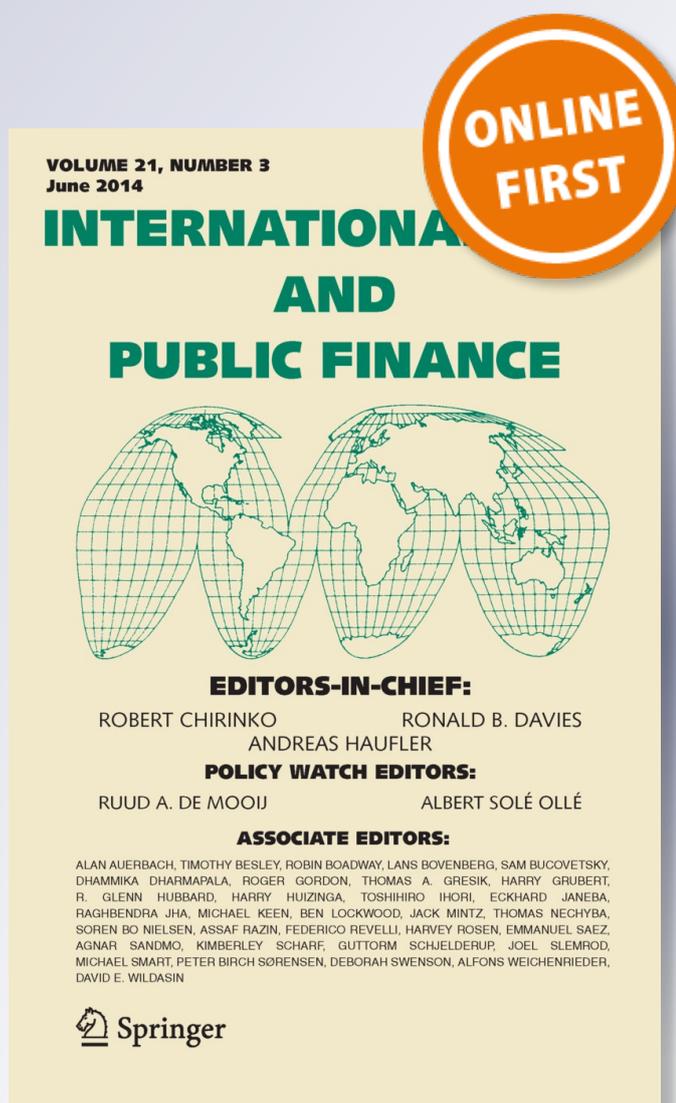
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## Tax compliance under horizontal and vertical equity conditions: An experimental approach

Massimo Finocchiaro Castro · Ilde Rizzo

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**Abstract** Tax compliance is a complex phenomenon, which requires to be addressed from different perspectives. We report the results of a real-effort experiment aiming at testing the effect of different equity conditions on individual tax compliance levels. We show that equity considerations seem to change individual behaviour only when a vertically unfair tax system is implemented. Also, random effects Tobit estimations show that being audited in the previous period has a negative effect on tax evasion, whereas the level of the fine paid in the previous period positively affects income underreporting. Also, we find that when subjects are in the vertical inequity condition they are significantly more likely to fully evade taxes than in the equity condition, whereas such result cannot be found in the horizontal inequity condition. Finally, we find a standard gender effect showing that female participants are less likely to evade taxes than man and that risk aversion negatively affect tax evasion behaviour.

**Keywords** Tax compliance · Vertical equity · Horizontal equity · Experiment

**JEL Classification** C91 · D63 · H26

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## 1 Introduction

Tax compliance is a complex phenomenon that requires to be addressed from different perspectives. Economic scholars commonly read tax compliance problem as a matter of rational decision making under uncertainty. However, this self-interested perspective to tax compliance has been criticised for being too narrow (Frey and Torgler 2007). In fact, social motivations rather than mere selfishness affect taxpaying behaviour, such as ethical concerns, tax morale and social norms. A relevant dimension of social interaction affecting tax compliance refers to equity issues. In a nutshell, equity theory suggests that individuals who feel they are in an inequitable situation strive to eliminate their distress by restoring equity. The greater the inequity, the harder they attempt to re-establish equity (Walster et al. 1973). In particular, tax evasion may be affected by the individual perception of his/her fiscal treatment concerning government provision of public goods and with respect to other taxpayers. Thus, taxpayers who perceive the tax system as inequitable are likely to report less income to restore equity (Cowell 1992). In the literature, the reaction of taxpayers to unfair tax system has been analysed through theoretical, empirical and experimental approach (Spicer and Becker 1980; Bordignon 1993; Cummings et al. 2009). The present paper investigates, in an experimental setting, how taxpayers respond to different horizontal and vertical equity conditions induced by a tax-rate change, keeping constant the exchange equity perception. For this purpose, we design a real-effort game where participants earn their endowment according to their ability to solve some simple tasks and we adopt a within-subjects design (i.e. each subject participates in all the treatments) to observe more clearly the reactions of participants to changes in horizontal and vertical equity, throughout the different tax-regimes. Our results show that subjects facing a tax system characterised by vertical inequity decrease tax compliance with respect to those facing an equitable tax system. We, thus, provide some support to equity theory suggesting that individuals are more likely to comply with rules if they perceive the system as fair, whereas they will evade taxes to restore equity in the system. Also, we run random effects Tobit estimations showing that being audited in the previous period has a negative effect on tax evasion, whereas the level of the fine paid in the previous period positively affects income underreporting. Also, we find that when subjects are in the vertical inequity condition they are significantly more likely to fully evade taxes than in the equity condition, whereas such result cannot be found in the horizontal inequity condition. Finally, we find a standard gender effect showing that female participants are less likely to evade taxes than man and that risk aversion negatively affect tax evasion behaviour.

We contribute to this stream of literature providing a simple and clear design to avoid any possible confounding effects in the experimental design (generally due to the simultaneous presence of horizontal or vertical equity combined with exchange equity) that, according to our opinion, have influenced several previous experimental works on this issue.

The paper is organised as follow: Sect. 2 briefly reports the main findings of the relevant literature, Sect. 3 presents the experimental design, Sect. 4 reports the empirical results. Finally, Sect. 5 offers some concluding remarks.

## 2 A brief survey of the literature

The research question posed by this paper looks at a very specific issue—the relationship between the propensity to evade and the vertical/horizontal equity of the fiscal system—adopting an experimental approach. The theoretical as well as empirical literature dealing with tax evasion is very wide and highly heterogeneous and a comprehensive review is outside the scope of this paper; in very general terms, as summarised by [Bloomquist \(2003\)](#), two ‘competing views’—expected utility theory and behaviour theory—have been developed and our contribution refers to the latter.

Indeed, since the papers by [Allingham and Sandmo \(1972\)](#) and [Yitzhaki \(1974\)](#) based on the expected utility maximization calculus, the individualistic approach to tax evasion has been increasingly questioned from various perspectives. A widely shared consideration is that people are more honest than deterrence models would suggest as it is demonstrated by the fact that tax evasion is less frequent than the models would predict; as a consequence, the determinants of tax behaviour cannot be restricted only to a portfolio decision under uncertainty. To the questions why many taxpayers comply and what are the factors affecting tax compliance several contributions answer that factors such as social norms, tax morale, ethical concerns and perception of fairness affect tax behaviour. Taxpayers’ behaviour has been studied theoretically and empirically, using field data as well as surveys and laboratory experiments. The latter have several advantages: the relevant elements of tax reporting (enforcement effort, tax rate, equity, income level) can be easily controlled while the reliability of field data and surveys is often questionable because of the difficulty of obtaining honest responses on illegal behaviours; laboratory experiments provide a true measure of individual reporting behaviour that in the ‘true world’ is usually concealed; survey data may not reflect the true size of tax evasion because respondents may tend to answer in a socially desirable way to avoid social stigma; the level of information provided to participants can be easily controlled and manipulated. On the other hand, experimental research has its own limitations because of its artificial nature: experiments may not clearly reflect the ‘true world’ and, thus, may not be able to reach acceptable levels of external validity; the recruited samples may not always be representative of the true population; groups are constituted artificially just to carry out the experiment. Therefore, caution is needed to generalise experimental results.

[Halla \(2010a\)](#) outlines that an increasing number of studies have addressed the complex concept of tax morale and of its relationship with tax compliance and stresses the methodological problems related to the measurement of the concept of tax morale and to the assessment of a causality link with tax compliance. Tax morale can be defined as ‘the intrinsic motivation to pay taxes arising from a moral obligation to pay taxes as a contribution to society’ ([Cummings et al. 2009](#)). Indeed, as [Frey \(2003\)](#) suggests, ‘tax morale must be put in the general context of the relationship between citizen and the state’. In general terms, such a relationship can be considered as an implicit relational contract built on trust in government. If the state is trustworthy, taxpayers might be more inclined to comply with the taxes; if the system is perceived as unfair taxpayers’ incentives to act against the tax law will increase since the related psychological costs are reduced. Thus, as [Torgler \(2002b\)](#) points out, tax rules establishing fairness and equity help preserve tax morale. [Lago-Peñas and Lago-Peñas \(2010\)](#) provide

a very comprehensive survey of the determinants of tax morale and show that tax morale in European countries is a function of individual- and contextual variables, being affected by socio-demographic characteristics, personal financial experiences, political attitudes as well as by regional GDP and tax arrangements. [Torgler \(2003\)](#), using data from the World Values Survey (WVS) with reference to Canada, finds evidence that trust in government, pride, and religiosity are found to exert a systematic positive influence. [Frey and Torgler \(2007\)](#) suggest that taxpayers cannot be considered as isolated individuals because tax compliance takes place in a social context and, therefore, being taxation a social act, conditional cooperation is an important factor to explain the extent of tax morale and tax evasion. They find empirical evidence for Western and Eastern European countries that tax morale decreases if taxpayers perceive that tax evasion is a common phenomenon while tax morale increases if other taxpayers are perceived to be honest.

Some support for the effects of social norms on individual tax compliance decisions is also provided by [Alm et al. \(2009\)](#); they use experimental methods to examine the effects on tax compliance of taxpayers' awareness about tax audit and, among the other things, they also find that when messages from other taxpayers report substantial levels of compliance among taxpayers, individuals are more likely to comply in subsequent rounds. [Bayer and Sutter \(2004\)](#) present an experimental study and find evidence that moral constraints, i.e. an additional psychological cost  $K$  of non-compliance, may provide an effective deterrent to tax evasion. The possible explanation is that these perceptions foster positive attitudes towards the state and taxation, affect the taxpayer behaviour, increase tax-evasion scruples and, therefore, reduce tax evasion. As far as the effects of tax morale on tax compliance are concerned, [Halla \(2010b\)](#) provides evidence that a causality link does exist and that tax morale can explain the fact that individuals pay taxes, even if audit probabilities and penalty rates are low.

Another relevant dimension of social interaction affecting tax compliance refers to equity issues. The psychology literature has widely investigated the equity theory as one of the first model of distributive justice ([Adams 1965](#)). Surveys on this topic show that perception of tax system inequity and tax evasion are positively linked ([Spicer 1975](#); [Hashimzade et al. 2010](#)). In fact, taxpayers may aim at restoring equity by evading taxes, given that an inequitable exchange relationship causes a sense of distress followed by anger, especially for the victim ([Torgler 2002a](#)).

Generally, tax evasion may be affected by the individual perception of his/her fiscal treatment concerning government provision of public goods and with respect to other taxpayers. As far as the former perspective is concerned, [Spicer and Becker \(1980\)](#) suggest that taxpayers' perceptions about the equity of the exchange relationship with government affect tax evasion decisions though they are not able to assess precisely the value of such exchange: tax evasion is found to increase for 'victims' of fiscal inequity but decreases for those who benefit. [Bordignon \(1993\)](#) suggests that the taxpayer can compute the fair terms of the trade between his/her private consumption and the provision of public good and evasion takes place when these terms are perceived as unfair. [Kim \(2002\)](#) in an experimental study reports that equity matters for taxpayers compliance: taxpayers receiving the same public transfer exhibit a different behaviour depending whether the exchange equity is taken into account in making their tax decisions. The experimental analysis presented by [Alm et al. \(1993\)](#) suggests that the

institutional features (whether the provision of public good is decided by majority vote or not and the level of popular support) of fiscal exchange affect taxpayers' compliance. [Cummings et al. \(2009\)](#), using survey data and laboratory experiments for different countries find that the quality of political institutions and how taxpayers perceive government have a relevant effect on tax compliance

As it was mentioned before, in the literature, the effects of the tax structure and its perceived equity on tax compliance are investigated too. The analysis of the effects of tax equity on tax evasion has been carried out disentangling the two concepts of horizontal and vertical equity. The relationship between the two concepts is complex and will not be investigated here; however, following [Musgrave \(1990\)](#), it might be useful to stress that normative values should be attributed to both.

So far, in the literature the analysis of the effects of horizontal or vertical equity has been combined with the investigation of exchange equity. [Torgler \(2002a\)](#) analyses the effects of vertical equity and exchange equity on tax behaviour finding that vertical inequity affects tax compliance, with low income taxpayers being more likely to evade than high income ones while less clear effects are exerted by exchange equity. [Fortin et al. \(2007\)](#) find that horizontal equity affects tax reporting in the sense that the perception of unfair taxation may lead to an increase in tax evasion. Finally, [Moser et al. \(1995\)](#) show the effects of horizontal equity in combination with exchange equity.

### 3 The experiment

#### 3.1 The design

A total of one hundred twenty students with different backgrounds (economics, law, political science, medicine) joined our experiment. We conducted eight sessions in groups of 15 subjects. Each session lasted for about forty minutes. The experimental currency earned throughout the thirty periods of the game were converted into euros at the exchange rate of 1,000 experimental currency (EC) = 1 euro at the end of the experiment. Subjects received 3.00 euros for participating on top of their earnings during the experiment. Average reward for participation, net of the attendance fee, was 12.00 euros.<sup>1</sup>

Our experimental design aimed at testing the effects of horizontal or vertical inequity conditions on individual tax compliance. For this purpose, participants have been asked to decide how much of their income to report in order to be taxed according to the announced tax rates in each period of the experiment. However, before moving to the detailed description of the income-reporting phase, two introductory phases of the experimental design must be discussed.

In the first introductory phase, we provided an assessment of individual's attitude towards risk. In fact, also in behaviour models, it is outlined that individual decisions in the field of tax evasion may be also affected by the risk attitudes of subjects. [Torgler \(2002a\)](#) and [Fortin et al. \(2007\)](#) control for such issue assessing the number of risk averse, risk neutral and risk seeking participants. For this reason, as first task of

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<sup>1</sup> The instructions are reported in the Appendix 2.

the experiment, we asked participants to complete a brief questionnaire to evaluate the level of risk attitude as suggested by [Holt and Laury \(2002\)](#). The questionnaire has been based on ten choices between paired lotteries A and B. Given the payoffs structure and the probabilities assigned to the different payoffs, it has been possible to evaluate individual's risk attitude by the number of times each player chooses lottery A before switching to B. Doing so we have been able to verify if the distribution of risk loving/neutral/averse subjects was common to other experiments. Nevertheless, we acknowledge that the [Holt and Laury \(2002\)](#) procedure may lead to inconsistent risk preferences when subjects switch back from lottery B (risky choice) to lottery A (safe choice) more than once. At the same time, authors report that the number of players switching back and forth between lotteries has been low and that, in most of the cases, a clear-cutting point between clusters of A and B choices existed, making it possible to assess the attitude towards risk of the majority of subjects. The results of the questionnaire we have implemented showed that the level of risk aversion of participants to the experiment was high, similar to the results obtained by [Holt and Laury \(2002\)](#). Almost two-thirds of subjects chose more than the four safe choices predicted by risk neutrality<sup>2</sup> and only 16% of subjects showed inconsistent risk preferences. Therefore, most of the subjects can be classified as risk averse according with economic wisdom.

In the second introductory phase, we implemented the real effort condition. As suggested by recent experimental literature ([Bruggen and Strobel 2007](#)), providing subjects with endowments like 'manna from heaven' seems to affect their behaviour compared with the case in which subjects are asked to perform some easy tasks to gather their endowments. Looking at experiments on taxation, a common result is that the adoption of a real effort procedure usually leads to higher levels of tax compliance ([Torgler 2002a](#)). Also, such characteristic, together with the adoption of in-context instructions, provided our experimental setting the needed level of 'parallelism' to the world outside the lab, as measure of internal validity, that is indispensable for the applicability of experimental findings ([Schram 2005](#); [Plott 1987](#); [Smith 1982](#)).

The real effort condition required participants to solve three simple exercises of reading comprehension by answering to five multiple choices questions for each reading in fifteen minutes. They were told that, according to the number of correct answers<sup>3</sup>, the software would have allocated each participant into three possible levels of income 200, 300 and 400 EC, respectively. In each session, five subjects have been allocated in each income class according to their performance in the reading and comprehension task. The income allocation mechanism was common knowledge to all participants but none was able to guess the income of other participants to the experiment. For instance, if subject  $j$  was allocated to the low income class (200 EC), he/she would know that other 4 subjects had also the low income, that five subjects had the middle income (300 EC) and that other 5 subjects had the high income (400 EC). Finally, each subject knew that his/her own income, as well as the income of the other participants, would remain the same throughout the whole experiment.

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<sup>2</sup> The distribution of safe choice frequencies is reported in the Appendix 1.

<sup>3</sup> If two or more subjects provided the same number of correct answers, the software ranked them according to the speed in completing the task.

Once the introductory phases were over, subjects started the income-reporting phase. It lasted for thirty periods during which each individual decided how much of his/her earned income to report and to be taxed according to the announced tax rates. The structure of tax rates changed each ten periods. Subjects were aware of the number of rounds and that the income-reporting phase would have been divided into three sub-phases of ten periods each. Subjects have been told that the only difference among the three sub-phases was the tax structure and that they would have received the Tables<sup>4</sup> reporting the changes in the tax structure at the beginning of each sub-phases. Similarly to other experiments, taxes were deducted at source.

The adoption of different tax schemes reflects our research question. The experimental literature provides some ambiguous results regarding the effects of horizontal and vertical inequity on tax compliance decisions, as shown in the previous section. For this reason, we decided to build a very simple experimental design. The tax scheme of the first ten periods represents the case of both horizontal and vertical equity and provides us with a useful benchmark. The change in the tax rates enforced during the periods 11–20 reflects the case of vertical equity and horizontal inequity,<sup>5</sup> whereas in the last ten periods the tax scheme represents the case of vertical inequity and horizontal equity.<sup>6</sup> Finally, our experimental design has been built on a within-subjects scheme to study the change of individual's behaviours across the three tax structures.<sup>7</sup>

Keeping constant and equal to zero the exchange equity, we focus on the responses of taxpayers to changes in the perception of horizontal or vertical inequity. Differently from other experimental works, we do not investigate the effects of exchange equity on personal income tax compliance. In other words, we do not add a public good game in the experimental design to assess whether taxpayers are more willing to pay taxes if they give a positive value the expenditures financed from tax revenues (Alm et al. 1993). Outside the laboratory, taxpayers generally are not able to perceive which public goods or services are provided, at national level, by means of personal income taxation since it is not possible to establish a relationship between the individual income tax burden and the benefits from public spending. As a consequence, in this case, the effect of inequitable exchange between taxpayers and the State may be quite low. Thus, we believe that it may be worth restricting our analysis to the taxpayers' fairness perceptions of the tax system in terms of horizontal and vertical equity also to increase the level of 'parallelism' to the real world.

In each period, after the income reporting decision, the auditing procedure took place. It required that each individual played a lottery with 0.2 probability to be checked

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<sup>4</sup> The three tables showing the different tax structures can be found in Appendix 2.

<sup>5</sup> It resembles the case of a progressive comprehensive income tax in a lifetime perspective (Longobardi 2009).

<sup>6</sup> It resembles the case of a regressive income tax rate (Longobardi 2009).

<sup>7</sup> The alternative choice would have been a between-subjects design where different individuals play in different tax rate structures. However, given that the aim of the paper is to analyse individual responses to changes in horizontal or vertical equity of tax structure, we believe that a within-subjects design would be more appropriate although it may suffer of learning effects.

and 0.8 of not being checked.<sup>8</sup> The auditing procedure implies that the current period and the three previous periods' reported incomes are checked. If an underreporting is found in the current period, the sanction amounts to 200% of the unpaid tax.<sup>9</sup> The same sanction is applied to any of the previous three periods if it is the case (Torgler 2002a). When the auditing procedure is over, a new period starts. In order to test for sequence effects, in half of the sessions the order of the treatments, each composed by fifteen participants, is reversed. The Mann-Whitney U test cannot reject the hypothesis of no sequence effects ( $p=0.75$ ). Moreover, we used an in-context wording clearly referring to tax rate, disposable income, audit probability and sanction rate for the experimental instructions to increase the external validity of the experiment. Doing so, we also believe that all the mechanisms of tax reporting activity should become clearer to all participants lowering the occurrence of errors in their choices.

### 3.2 The hypotheses

As shown in Sect. 2, the expected utility models cannot explain why the levels of compliance resulting from both field data and experimental works are higher than what predicted. High levels of cooperation are common results to other works on ultimatum games, dictator games, and public goods games. In all these cases, standard economic theory has been put aside in favour of other-regarding preferences theories like social comparisons theory, equity theory, fairness and conditional cooperation. Looking at the tax evasion problem, equity theory has been used in several experimental papers to explain their findings suggesting that taxpayers who perceive horizontal, vertical or exchange inequity will report less income to restore equity. Our design let us compare the decisions of participants when they experience horizontal and vertical inequity conditions. Thus our first hypothesis can be stated as follows:

*Hypothesis 1.* Subjects decrease their levels of tax compliance when moving from equity to inequity conditions.

Moreover, our experiment is also aimed at disentangling the effects of horizontal and vertical equity on tax evasion. Social comparison theory seems to suggest that individuals tend to compare their situation with peers sharing the same tax conditions to gather information on tax system mechanisms (Stanlans et al. 1991). Thus, being in a horizontal inequity condition, individuals should restore it by evading taxes. At the same time, individuals may experience inferiority and inequity from the disparity between their own wealth and that of a group to which they aspire. Also in this case, according to social comparison theory, individuals' perception of income inequality may embitter their reaction to vertical inequity, leading to inequity compensation by cheating on taxes (Smith and Kinsey 1987). The experimental results on the effects of horizontal inequity are mixed, whereas it seems that vertical inequity has a clearly

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<sup>8</sup> We realised this lottery by virtually rolling a dice with 10 faces and implementing the auditing procedure if the zero or nine face appear.

<sup>9</sup> Given our audit parameters, the predicted level of compliance for a risk-neutral decision-maker is zero. We compared the certain outcome of full compliance with the expected outcome of tax evasion, showing that the latter is always higher than the former for any level of undeclared income. Computations are available from the authors upon request.

negative effect on the tax compliance levels. (Torgler 2002a,b). Hence, it is hard to state whether participants behave in a different way when they move across different inequities (regardless the sequence of these movements). Thus, we state Hypothesis 2 as follows,

*Hypothesis 2.* The experience of Horizontal/Vertical inequity condition does not change the tax reporting decision when the participant moves to the other condition.

#### 4 Results and analysis

Table 1 shows the average levels of tax compliance according to income levels and equity conditions. The overall compliance level is 73 %, suggesting that an almost one out of four participant does not comply to tax payment. Looking at equity conditions, it is possible to note that differences are very small when moving from full equity to horizontal inequity condition, whereas if vertical inequity is at play the differences are much more evident. Thus, it appears that vertical inequity enhances tax evasion behaviour. In addition, considering the income levels, the level of compliance, of middle and high income subjects is always higher than that of low income subjects although, looking at average values, the differences are quite small.

To test our first hypothesis, we look at the levels of tax compliance in the three equity conditions. As reported in the previous section, subjects experiencing inequity conditions towards peers or members of higher income classes may reduce tax compliance to restore equity. Our experimental data provide support for such behaviour only when vertical inequity is at play. Given that we have opted for a matched-pairs protocol, we use the Wilcoxon test to look for significant differences among compliance levels. The test shows that there are no significant differences among the following conditions: Full equity vs. Horizontal inequity, ( $p=0.13$ ) and Horizontal inequity vs. Vertical inequity ( $p=0.11$ ). On the contrary, the level of tax compliance differs significantly when we compare Full equity with Vertical inequity ( $p=0.01$ ). Thus, vertical inequity condition seems to be the major driver of individual tax compliance choices compared with the benchmark condition of full equity. Hence, Hypothesis 1 cannot be rejected in the case of vertical inequity, providing support to equity theory that suggests that subjects evade taxes to restore vertical equity condition. Thus, our results show that participants behaved differently according to the kind of inequity they faced. Although horizontal equity is an important driver of the fairness of tax system assessing the occurrence of unequal tax burden across individuals with similar incomes, it may not have the same weight everywhere. For instance, in Italy, where there is no

**Table 1** Average tax compliance levels

	Full equity	Horizontal ineq	Vertical ineq	Av. by income
Low income	71.92	72.77	67.23	70.64
Middle income	78.00	73.26	69.25	73.52
High income	73.54	73.07	74.60	73.74
Av. by conditions	74.50	73.03	70.37	72.63

wealth tax, personal income taxation has been strongly focused on vertical equity with a high degree of progressivity. As a matter of fact, in terms of horizontal equity, even if starting from the same income level derived from the same source as in our experiment, two taxpayers may end up paying significantly different amounts of taxes due to the effect of tax deductions or allowances, which account for the presence of children, disabled or elderly people living with the taxpayer. Hence, in our experiment, horizontal inequity may have been perceived as 'less unfair' than vertical inequity providing fewer incentives to tax evasion.<sup>10</sup> On the contrary, vertical equity seems to have a stronger weight, together with exchange equity, on the fairness evaluation of a tax system. Hence, participants reacted to the introduction of vertical inequity, through a regressive tax scheme, under-reporting income more significantly than in the other inequity condition and supporting the prediction of equity theory.

As expected, also Hypothesis 2 cannot be rejected by our experimental data showing that participants do not behave in a different way when they move across different inequities (regardless the sequence of these movements), e.g. the experience of one of the two inequity conditions (either vertical or horizontal) does not change the tax reporting decision when the participant moves to the other condition. As mentioned above, subjects may experience inferiority and inequity from the disparity between their own wealth and that of a group to which they aspire and, thus, aim at restoring equity by cheating on taxes (Smith and Kinsey 1987). Hence, it may be the case that belonging to different income classes increases the perception of the inequity of tax system. For this reason, we have run the non-parametric Wilcoxon test to look for differences in the tax compliance decisions within each income class. In particular, this difference should be more evident checking the behaviours of low income (200 EC) and high income (400 EC) subjects in the Vertical inequity condition. The Wilcoxon test does not report any significant difference within each income class on the levels of tax compliance. This result holds also when we compare the decisions of low income subjects and those of high income subjects, regardless of the treatment in which they play.<sup>11</sup>

In addition, we have checked the trends of tax compliance level within each income group, across the thirty periods of the experiment e.g. under the three conditions (full equity, horizontal inequity, vertical inequity). Figure 1 shows that the three patterns are very similar. Although in some periods there are differences across income groups, few of them are significant.<sup>12</sup> Thus, looking at the behaviour of each income group across periods, inequity seems not to affect individual tax compliance depending of the taxpayer's income.

It has to be noted that the three lines reported in Fig. 1 show the decreasing and increasing trend right after period 10 and 20, with the latter being more evident. This behaviour, common to all three income classes, seems to reflect the switch to a new tax scheme. In fact, from period 11 a new tax regime starts and the audit process is less

<sup>10</sup> It has also to be noted that the analysis of horizontal equity has provided mixed results (Torgler 2002b).

<sup>11</sup> The Wilcoxon test reports the following results: Full equity condition ( $p=0.87$ ), Horizontal inequity condition ( $p=0.70$ ), Vertical inequity condition ( $p=0.47$ ). The  $p$  values of all the remaining combinations of income classes and inequity conditions are available from the authors upon request.

<sup>12</sup> The only exceptions are period 19 and 29 ( $p=0.04$  and  $p=0.01$ ).

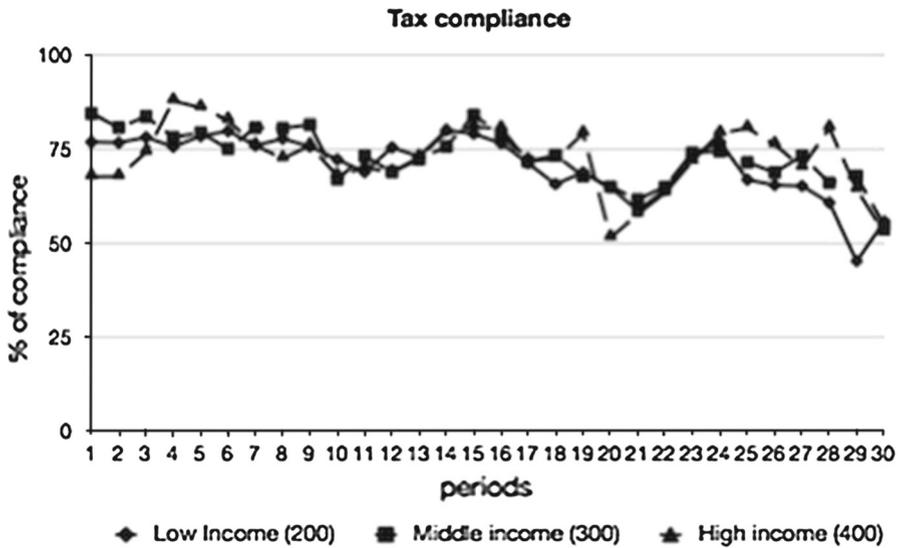


Fig. 1 Tax compliance

severe (if caught underreporting, a subject pays a sanction on unpaid taxes up to four previous periods) inducing participants to evade more than in the last periods of the previous tax regime. The same logic applies to the behaviour observed in periods 20–21 .

Our experimental design shares some results with the existing literature as far as the vertical inequity effects on tax evasion are concerned, whereas there is no evidence of the role played by horizontal inequity on tax individual compliance levels. Hence we provide some support to equity theory suggesting that individuals are more likely to comply with rules if they perceive the system as fair, whereas they will evade taxes to restore equity in the system (King and Sheffrin 2002). We also share our finding on the effects of vertical inequity on tax compliance with Torgler (2002a), although in our experiment the exchange equity is equal to zero and we do not find any difference in tax compliance across income groups .

We now turn to the regression of individual tax evasion levels on a set of commonly used explanatory variables referring to the experimental design and individual characteristics obtained through post-experimental questionnaire. The individual levels of tax evasion are our dependent variable, whereas the individual covariates include a dummy variable to account for having been audited in the previous period (Audit); the level of the fine paid in the previous period whether audited (Fine); the treatment effect measured by the dummy variable (Treatment) being equal to one in the case of Vertical inequity condition; the gender effect measured by the dummy variable (Gender) being equal to one for female participants; the occurrence of risk averse subjects measured by the dummy variable (Risk\_Av). Table 2 shows some descriptive statistics of the variables employed.

We report the results for random effect Tobit estimations in Table 3 (Alm et al. 2010). The analysis reveals a significant and negative effect of being audited in the previous period on the decision of tax evasion in the current period, which reflects the deterrence effect exerted by the auditing procedure. The amount of the fine paid in the

**Table 2** Variables employed

	Obs.	Mean	Std. dev.	Min.	Max
Tax_evasion	3,480	80.72	118.49	0	400
Audit	3,480	0.40	2.33	0	1
Fine	3,480	17.77	47.88	0	432
Treatment (Vertical inequity =1)	3,480	0.47	2.79	0	1
Gender (female=1)	3,480	0.52	0.49	0	1
Risk_Av	3,480	0.50	0.50	0	1

**Table 3** Random effects Tobit estimations with the level of tax evasion as dependent variable

	Coefficient	Std. err.	z-Test	p value
Audit	-44.50***	8.05	-5.53	0.001
Fine	1.62***	0.06	25.24	0.001
Treatment (Vertical inequity =1)	12.50**	6.38	1.96	0.05
Gender (female=1)	-24.80**	11.33	-2.19	0.03
Risk_Av	-34.11***	12.52	-2.72	0.006
constant	10.73	10.04	1.07	0.285
N	3480		Log likelihood	-10944.48
$\chi^2$	676.59	0.0001		

Significance levels at 10, 5, and 1 % are indicated by \*, \*\*, and \*\*\*, respectively

previous period has a positive and significant effect on tax evasion behaviour, even if the coefficient is very small, suggestive of 'gamblers' fallacy' behaviour (Alm and McKee 2006). As reported in the nonparametric analysis, when playing in the vertical inequity condition, compared to the full equity condition, participants increase the level of tax evasion, as suggested by the equity theory. Also, our results show the presence of a significant and negative gender effect, well known in the literature, stating that female participants are less prone to evade taxes than male ones. Finally, the risk aversion coefficient has a negative and significant effect on the level of individual tax evasion.

## 5 Conclusions

Our paper focused the attention on the role and the effects of taxpayers' equity perception on tax compliance, using an experimental approach. Some of the recent experimental literature focused on the relationship between equity perception and taxpayer compliance (Fortin et al. 2007; Torgler 2002a; Moser et al. 1995). We contributed to this stream of literature investigating on how, in an experimental setting, taxpayers respond to different horizontal and vertical equity conditions induced by a tax-rate change, keeping constant the exchange equity perception. We report the results of a real-effort experiment aiming at testing the effect of different equity conditions on individual tax compliance levels. The non-parametric analysis shows that the perception of vertical inequity has changed individual behaviour decreasing tax compliance with respect to the case of full equity. This result provides support to equity theory

suggesting that individuals are more likely to comply with rules if they perceive the system as fair, whereas they will evade taxes to restore equity in the system.

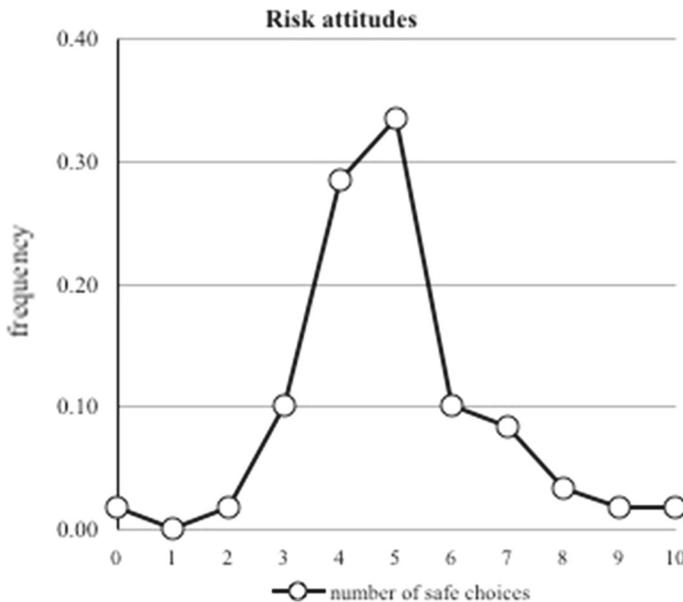
Also, we run random effects Tobit estimations showing that being audited in the previous period has a negative effect on tax evasion, whereas the level of the fine paid in the previous period positively affects income underreporting. Also, we find that when subjects are in the vertical inequity condition they are significantly more likely to fully evade taxes than in the equity condition, whereas such result cannot be found in the horizontal inequity condition. Finally, we find a standard gender effect showing that female participants are less likely to evade taxes than man and that risk aversion negatively affect tax evasion behaviour.

Though caution is needed, a tentative policy implication is that, in designing strategies to contrast tax evasion, the decision-maker, among the other things, should pay specific attention to the vertical equity of the tax system and to the level of audit probability.

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## Appendix 1

See Fig. 2.



**Fig. 2** Participants' risk attitudes

## Appendix 2

### Instructions

#### *Welcome to our laboratory*

You are taking part into an experiment about individual decision-making. The instructions are simple. According to your decisions and to the decisions made by the other members of your group, you can earn a considerable amount of money. The money you will earn will be paid to you, in cash, at the end of the experiment. Regardless of your performance in the experiment, you have already gained a €300 participation token.

Your earnings will be measured in EC and will be changed into euros at the end of the experiment at the following exchange rate: 1,000 EC = 1 Euro.

The University of Catania and the CNR have jointly provided the funds for this study.

If any of the instructions are unclear, or if you have any questions, please attract the attention of the experimenter by raising your hand. Please do not communicate with any other participant from now on.

#### *The experiment*

Before starting the experiment, you are asked to answer to some questions on the contents of three readings that will be provided to you as soon as you finish reading the instructions. You have 15 min to answer the questions. Then, the software will check your answers and will rank the participants according to the number of correct answers. According to your performance, you will be assigned an income class that will remain the same throughout the experiment. There are 3 available income classes: 200 EC, 300 EC and 400 EC. Each income class will contain 5 participants according to the number of correct answers provided. The higher the number of correct answers, the higher the assigned income class will be. In case of participants with the same number of correct answers, the higher income class will be assigned to the quickest in providing all the answers. Hence, at the end of the 15 min, you will know the number of correct answers and to which income class you will belong during the experiment. No other participants will know your income.

The experiment is divided into three phases, each lasting for 10 rounds. In each round, you will be asked to decide how much of your income to declare to the tax authority. After your decision, the audit procedure will start and the eventual sanctions will be applied. Once the audit procedure is over, you will see a summary of the round on your monitor and it will be possible to move to the following round. The structure of each round will be the same during the whole experiment.

The only difference between the three phases is given by the tax regime to be enforced. At the end of period 10, you will receive a new Table showing the tax regime of phase II and at the end of period 20 you will receive a new Table showing the tax regime of phase III.

At the end of phase III, a short questionnaire will be handed out. Please, fill it before leaving the laboratory.

*Audit procedure*

At the end of each round of each phase, your income-report may be audit with the probability of 0.2 (in other words, there are 2 possibilities out of 10 to be audited). On your monitor, you will see a ten-faces dice rolled by the software. You will be audited only if the dice shows number 0 or 9.

If your income-report is audited and the amount you have declared is lower than your income, you will be fined for an amount equal to 200% of the unpaid tax. Moreover, the previous four income-reports will be also checked. On the contrary, if the amount you have declared is equal to your income, you will not be fined and no other income-reports will be checked.

If you have any more questions, please, ask them before the experiment begins.

GOOD LUCK!

See Tables 4, 5 and 6

**Table 4** Level of income earned and tax structures in the full equity condition (vertical and horizontal equity)

Subjects	Earned incomes		
	200 EC (%)	300 EC (%)	400 EC (%)
1	10	18	27
2	10	18	27
3	10	18	27
4	10	18	27
5	10	18	27
6	10	18	27
7	10	18	27
8	10	18	27
9	10	18	27
10	10	18	27
11	10	18	27
12	10	18	27
13	10	18	27
14	10	18	27
15	10	18	27

**Table 5** Level of income earned and tax structures in the Horizontal inequity condition

Subjects	Earned incomes		
	200 CS (%)	300 CS (%)	400 CS (%)
1	8	14	21
2	12	225	33
3	15	27	40
4	18	32	48
5	20	36	54
6	8	14	21
7	12	225	33
8	15	27	40
9	18	32	48
10	20	36	54
11	8	14	21
12	12	225	33
13	15	27	40
14	18	32	48
15	20	36	54

**Table 6** Level of income earned and tax structures in the Vertical inequity condition

Subjects	Earned incomes		
	200 CS (%)	300 CS (%)	400 CS (%)
1	37	25	14
2	37	25	14
3	37	25	14
4	37	25	14
5	37	25	14
6	37	25	14
7	37	25	14
8	37	25	14
9	37	25	14
10	37	25	14
11	37	25	14
12	37	25	14
13	37	25	14
14	37	25	14
15	37	25	14

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