TAX COMPLIANCE UNDER HORIZONTAL AND VERTICAL EQUITY CONDITIONS. AN EXPERIMENTAL APPROACH

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Tax compliance under horizontal and vertical equity conditions. An experimental approach

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VERY PRELIMINARY DRAFT

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Abstract

Tax morale is a social phenomenon that is difficult to explain. Questions about tax compliance are as old as taxes themselves and will remain an area of investigation as long as taxes exist. We report the results of a real-effort experiment aiming at testing the effect of different equity conditions on individual tax compliance levels run in a static and dynamic context. We show that in a static context, considering any possible level of tax evasion, equity considerations do not seem to change individual behaviour and, as a consequence, the levels of tax compliance across treatments remain almost constant. However, looking at full tax evasion behaviour and applying estimation models suggested by survival analysis, 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. The same results can be found in a static context dealing with full tax evasion. Furthermore, there is a strong gender effect showing that female participants are less likely to report zero income independently of the inequity conditions they face.

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1. Introduction

Tax morale is a social phenomenon that is difficult to explain. Questions about tax compliance are as old as taxes themselves and will remain an area of investigation as long as taxes exist. Economists see the problem of tax morale as one of rational decision making under uncertainty. However, this self-interested perspective to tax compliance has been criticised for being too narrow. It assumes that social motivations rather than mere selfishness affect taxpaying behaviour, such as ethical concerns and social norms, perception of fairness and legitimacy. Starting from these grounds, we focus our attention on the role and the effects of taxpayers' equity perception on tax compliance, using an experimental approach. Our study will contribute to this stream of literature focusing 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. Most of the previous works on this issue, according to our opinion, does not clearly control for possible confounding effects due to the simultaneous presence of more than one type of equity (horizontal or vertical equity combined with exchange equity) in the experimental design. A second relevant issue sometimes neglected by researchers, it is the potential change in subject behaviour if his/her endowment is earned instead of received as *manna* from heaven, as common to most of the experiments. For this reason, we design a real-effort game where participants earn their endowment according to their ability to solve some simple tasks. Also, we opt for a within-subjects design, i.e. each subject participates in all the treatments, to better study the reaction of participants, throughout the different tax-regimes, to changes in horizontal and vertical equity. The paper is organised as follow: section 2 briefly reports the main findings of the existing theoretical and experimental literature, section 3 presents the experimental design, section 4 and 5 describe the empirical results and section 6 offers some concluding remarks.

2. A brief survey of the literature

2.1. 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 paper by Allingham and Sandmo (1972) 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 the advantage that 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 On the other hand, experimental research has its own limitations because of its artificial nature: groups are constituted artificially just to carry out the experiment and, therefore, caution is needed to generalize experimental results.

2.2. Halla (2010a) outlines that an increasing number of studies have addressed the complex concept of tax morale – e.g. the intrinsic motivation to pay taxes arising from a moral obligation or

the belief in contributing to society through taxes - 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. Lago-Peñas - 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-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 finds 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 toward 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 is concerned, Halla (2010b) provides evidence that a causality link does exist and that tax morale can offer an explanation for the fact that individuals pay taxes, even if audit probabilities and penalty rates are low.

2.3. Another relevant dimension of social interaction affecting tax compliance refers to equity issues. Tax evasion may be affected by the individual perception of his/her fiscal treatment with reference to 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-Jackson (1992) 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 impact on taxpayers' compliance. Cummings et al. (2005), 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

2.4. 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 (2002) 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 the perception of unfair taxation may lead to an increase in tax evasion. Effects of horizontal equity in combination with exchange equity are presented by Moser et al. (1995). So far the effects of vertical and horizontal equity have not been jointly examined.

3. The design

3.1 *The game* Our experimental design aims at testing the effects of horizontal or vertical inequity conditions on individual tax compliance. 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 (2002) and Fortin et al (2007) control for such issue assessing the number of risk averse, risk neutral and risk seeking participants. For this reason 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 he 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. The results of the questionnaire show that the level of risk aversion of participants to the experiment is 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 [1]. Therefore, most of the subjects can be classified as risk averse like commonly assumed by economic models.

The second feature of the design we have implemented is 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, 2002). Also, such characteristic increases its external validity making the experiment less artificial.

In our experiment, subjects had to solve in fifteen minutes three simple exercises of reading comprehension by answering to five multiple choices questions for each reading. They were told that, according to the number of correct answers[2], the software would have allocated each participant into three possible levels of income 200, 300 and 400 experimental currency (EC), respectively. At this point, each subject was only aware of his/her available income at the beginning of each period of the experiment and that there were three levels of income. None was able to guess the income of other participants to the experiment.

Once the initial part of the experimental session was over, subjects started the income reporting phase. This phase 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. Similarly to other experiments, taxes were deducted at source. The structure of tax rates changed each ten periods. Subjects were aware of the future changes of the tax structure but knew the tax rates only when they were enforced. In each period, after the income reporting decision, the auditing procedure took

[1] See appendix A.

[2] If two or more subjects provided the same number of correct answers, the software ranked them according to the speed in completing the task.

place. It required that each individual plaid a lottery with 0.2 probability to be checked and 0.8 of not being checked. We realised this lottery by virtually rolling a dice with 10 faces and implementing the auditing procedure if the zero or nine face appear. 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 levied amounts to 200% of the unpaid tax. The same sanction is applied to any of the previous three periods if it is the case (Torgler, 2002). 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 more clear to all participants lowering the occurrence of errors in their choices.

A total of sixty students with different backgrounds (economics, law, political science, medicine) joined our experiment. 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 1000 EC = 1 euro at the end of the experiment. Subjects received 3.00 euros for participating, in addition to their earnings during the experiment. Average reward for participation, net of the attendance fee, was 12.00 euros.

The adoption of different tax schemes reflects our research question. 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. The existing experimental studies provide some contrasting results as shown by previous section. For this reason, we decided to build the simplest possible design to isolate the effects of horizontal and vertical inequity on income reporting decisions. Thus the tax scheme of the first ten periods represents the case where there is 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,[3] whereas in the last ten periods the tax scheme represents the case of vertical inequity and horizontal equity[4].

Moreover, our experimental design is built on a within-subjects scheme to study the change of individual's behaviours moving through the three tax structures. 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.

3.2 *The Hypotheses* As shown in section 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 state as follows:

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

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[3] A similar case may occur with a progressive comprehensive income tax in a lifetime perspective (Longobardi, 2009).

[4] A similar case may occur with a flat income tax rate (Longobardi, 2009). The three tax schemes are shown in the appendix B.

Moreover, our experiment is aimed at disentangling the effects of horizontal and vertical equity on tax evasion. Social comparisons theory seems to suggest that individuals tend to compare their situation with peers sharing the same tax conditions for 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, subjects often tend to look to other higher social groups to which they aspire belonging to. Also in this case, individuals may react to vertical inequity condition by cheating on taxes to compensate the inequity. Hence, we cannot make any hypothesis on which inequity conditions, if any, may affect more tax compliance.

Hypothesis 2. H*orizontal/vertical inequity have different impact on tax compliance levels*

4. Nonparametric results

Table 1 shows the average levels of tax compliance according to income levels and equity conditions. The overall compliance level is 66%, suggesting that almost one out of three participants does not comply to tax payment. Looking at equity conditions, it is possible to note that differences are very small (slightly more than 5% comparing full equity with vertical inequity conditions) showing that subjects did not seem to consider equity issues when choosing the amounts to report. By contrast, considering the income levels, the level of compliance increases with income. Also in this case, on average, the differences are quite small (slightly more than 10% comparing low with high income groups).

- Table 1 here -

To test our first hypothesis, we look at the levels of tax compliance in the three equity conditions. As reported in previous section, subjects experiencing inequity conditions towards peers or

members of higher income classes should reduce tax compliance to restore equity. Our experimental data do not provide support for such behaviour. 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 conditions: Full equity vs. Horizontal inequity, p=0.54; Full equity vs. Vert inequity, p=0.17; Horizontal inequity vs. Vertical inequity, p=0.75. The first two results show that inequity conditions did not produce any change in individual tax compliance levels compared with the benchmark condition of full equity. The last result describes the absence of differences between the effect of horizontal and vertical inequity on individual tax decisions. Thus also Hypothesis 2 can be rejected by our experimental data.

To check for the robustness of our results, we performed the above mentioned comparisons among conditions within each income group. Figure 1 reports the patterns of tax compliance of each of the three income group across the equity conditions. Data show that the three patterns are very similar. In some periods there are some differences among income groups but almost none of them is significant[5]. Thus also restricting the analysis to the behaviour of each income group, inequity seems not to affect individual tax compliance.

Our experimental design provides different results compared with the existing literature as far as the equity effects on tax evasion are concerned. Indeed, in our experiment horizontal/vertical inequity do not seem to have significant effects on tax compliance. Of course, our results are not comparable with those provided in the relevant literature because of the differences in design. Our results do not seem to depend on confusions on the separate effects of tax rate changes on vertical and horizontal inequity since the instructions have been explained in depth to the participants **(**see above paragraph 3.1**).** A possible explanation, however, might rely on the fact that disregarding exchange equity is likely to lower the impact of inequity on taxpayer choices because the taxpayer is less aware of

[5] The only exceptions are period 19 and 39 (p=0.04 and p=0.01).

what he /she receives out of the taxes paid. *Mutatis mutandis*, it might be argued that the absence of exchange generates fiscal illusion and, therefore, lowers taxpayers' reactions against taxation. Moreover, the method of tax payment adopted – e.g. taxation at source - is usually considered to favour fiscal illusion.

- Figure 1 here -

5. Survival analysis

5.1 *Econometric models* Many of the designs of the experimental papers on tax evasion presented in section 2 are not one-shot games. Nevertheless, few of them considered the effect of time on individual decision in their data analysis (Torgler, 2002). In our design, each participant goes through thirty rounds and, thus, we believe that time may play an important role which has to be taken into account in the analysis. Among the econometric techniques that can be applied to study time effects, we use the survival analysis model. This technique were initially developed in health sciences to study the rate of mortality, first, and the effectiveness of treatments on the remission of several diseases. More recently, it has been applied to different fields such as marriage (Smith and Zick, 1994), unemployment spells (Moffit 1985; Taylor, 1999), political science (Box-Steffensmeier and Jones, 1997) and fiscal policy (Gupta et al, 2004). To the best of our knowledge the first attempt to adapt survival analysis to an experimental paper on tax evasion is the above-mentioned work of Torgler (2002).

Generally, survival analysis is a set of statistical procedures for data analysis for which the outcome variable of interest is time until an event occurs (Kleinbaum and Klein, 2005). In this setting two variables are important: the hazard rate and the survival function. The first one represents the

relative risk that an individual will fully evade taxes, provided that he/she was not evading taxes in the previous period:

$$\hat{h}(t) = \frac{d_t}{n_t} \tag{1}$$

where d_t represents the number of failures (full tax evasion) recorded in period t, and n_t is the surviving population (subjects not evading) in period t, before the change in status (a new full tax evasion) occurs. The survival function gives the probability that a subject survives (does not fully evade taxes) longer than some specified time t and it can be obtained by the product of one minus the existing risk until period t:

$$\hat{S}(t) = \prod_{j|t_j \le t} \left(\frac{n_j - d_j}{n_j} \right) \tag{2}$$

A widely used mathematical model for analysing survival data is the Cox proportional hazards (PH) model that assumes that the hazard function can be described as follows:

$$h(t, X) = h_0(t) * e^{\sum_{i=1}^{p} \beta_i X_i} \tag{3}$$

where $h_0(t)$ is called the baseline hazard function and the second term is the function of individual covariates. This model has two important features. The first one, called PH assumption, is that $h_0(t)$ is a function of t but does not involve the covariates. The second one refers to the fact that the model can be estimated without imposing any specific functional form to the baseline hazard function. This feature makes the Cox model a semiparametric model. The Cox PH model is very popular among researchers because provides good estimates of regression coefficients and hazard

ratios. Moreover, it is said to be a robust model in the sense that its results closely approximate those of the correct parametric model (Kleinbaum ad Klein, 2005). An alternative to the Cox PH model are the parametric survival models in which the distribution of the time to event variable is specified in terms of unknown parameters, that are estimated from the data.[6] In our case, as it can be seen below, the choice between the two models is not crucial since the results obtained with both models are very close. However we prefer to use Cox PH model because it imposes less constraints does not require specific assumptions on the functional form and, therefore, its results can be more easily generalized.

5.2 *General Data Layout* Commonly, survival analysis models are applied to outcome events that may occur only once over the observation period. By contrast, in our experiment, outcome events may occur more than once and are, thus, called recurrent events. However, such a difference can be easily handled through a specific data set construction. Data layout in this case has to be constructed such that each subject has a line of data corresponding to each recurrent event. Thus, two different approaches can be used: the Counting Process Approach (Andersen et al, 1993) and the Stratified Cox Model Approach. The former is used when recurrent events are treated as identical, whereas the latter can be applied when recurrent events involve different categories or the order of the events is considered important. Given our experimental design we adopt the Counting Process Approach in which each line of data for a given participant lists the start time and stop time for each interval of follow-up. Thus, our outcome or survival time variable (**Time_stop**) reports the length of time (e.g. the number of time periods) during which full tax evasion takes place and the dichotomous variable takes value 1 for failure (**Event_status, e.g. tax evasion**).

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[6] Examples of distributions that are widely adopted are: the Weibull, the exponential, the log-logistic, the lognormal and the generalised gamma. If the researcher is quite secure with the distributional assumption, then parameters can be estimated that fully specify the survival and hazard functions. In addition, survival estimated gathered from parametric models yield graphs more consistent with a theoretical survival curve. For instance, the Weibull model is the most commonly used parametric survival model and the hazard function is $h(t) = \lambda p t^{p-1}$, where p and $\lambda > 0$. The parameter p is called the shape parameter in that determines the shape of the hazard function.

Investigating this type of data can be done using either the Cox PH model or any parametric model. However, there are two differences in the way the Cox PH model is applied to recurrent events data compared to nonrecurrent data. The first one refers to the fact that a participant remains in the risk set until his/her last interval after which the participant is removed from the risk set, whereas for nonrecurrent event data, each subject is removed from the risk set at the occurrence of the event. Second, each recurrent event of the same participant is treated as if it belongs to a different participant. Thus, it is necessary to adjust the variance of estimated model coefficients for the expected correlation among recurrent events on the same subject adopting the common robust estimation technique.

5.3 *Data* Our experiment provides data on the reported income of sixty subjects over thirty periods. At a first glance, it would seem correct to use all the individual decisions taken during the experiment to analyze the temporal dynamic of tax compliance. However, it would have been very difficult to distinguish among the several possible levels of evasion. For instance, should we treat differently subject A who evades 10% of income versus subject B who evades 90% of income? In addition, low levels of evasion may be due to errors or confusion rather than to the clear decision of not fully paying taxes. Therefore, our empirical analysis will focus only on full tax evasion. In other words, the outcome event on which we have built the data layout for the survival analysis is the occurrence of full tax evasion during the period of observation. Two other features of our data have to be noticed before moving to the empirical results. First, our experimental design requires each participant to join all the three treatments, survival analysis cannot compare the benchmark treatment (e.g. full equity) with two different treatments at once. Thus, we have chosen to compare separately each of the treatments with the benchmark treatment, running two survival analysis (equity treatment vs. horizontal inequity treatment; equity treatment vs. vertical inequity treatment). Second, in the usual application of survival analysis each subject takes part to just one treatment.

For instance, in health studies, each subject is selected either for the placebo or the drug treatment. Thus, the data layout for recurrent events requires that the data lines referring to the same subject belong to one treatment only, whereas in our case each subjects has data lines regarding the treatment under study and benchmark. To avoid the software to count the choices of each individual in the two treatments as made by two different subjects, we use a cluster variable to run the survival analysis.

Considering equation (3), the probability of full tax evasion is regressed on a set of commonly used explanatory variables referring to the treatment effect and socio-economic characteristics of the participants to the experiment that may affect the duration of any level of tax compliance. The individual covariates include the treatment effect measured by a dummy variable (**Treat**), the gender effect measured by a dummy variable (**Gender**), the presence of high number of participants studying economics measured by a dummy variable (**Degree**), the age of participants (**Age**), the income level of participants' family (**Income**), the presence of risk averse participants measured by a dummy variable (**Risk_Av**), and the effect of audit measured by a dummy variable that equals 1 when a subject has been audited six or more times (**Audit**)[7]. Hence, the Cox PH model for recurrent events can be written as follows,

$$\hat{h}(t,X) = \hat{h}_0(t)e^{\beta_1 Treat + \beta_2 Gender + \beta_3 Degree + \beta_4 Age + \beta_5 Income + \beta_6 Risk\_Av + \beta_7 Audit} \quad (4)$$

5.4 *Empirical Results* Table 2 reports the results of the semi parametric Cox PH model estimation [8]using data from the equity and the horizontal inequity treatments. The only variable that has a significant and negative effect on the probability of full tax evasion is **Gender**. This dummy variable shows that female participants are less likely to report zero income. It has to be noted that

[7] The average number of times a subject has been audited during the experiment is six.

[8] Results for the parametric specification are consistent with those of the semi parametric Cox PH model and are not reported here. They are available from the authors upon request.

the dummy **Treat** is not significant meaning that there is no statistically relevant effect of horizontal inequity on individual income reporting decisions.

- Table 2 here -

Results of the Cox PH model estimation referring to the equity and vertical inequity treatments are reported in Table 3. Also in this case we find a significant and negative gender effect on the probability of full tax evasion behaviour of subjects. Differently from the previous analysis, we find a highly significant treatment effect. Thus, the hazard for the vertical inequity treatment is 1.6 times the hazard for the equity treatment.

The application of survival analysis to individual full tax evasion choices shows that there is a strong gender effect in both models showing that female participants are less likely to report zero income. In addition, when subjects are exposed to vertical inequity condition are more likely to fully evade taxes rather than when they are in the equity condition. Therefore, vertical inequity seems to affect more strongly individual reporting decisions than horizontal inequity condition.

- Table 3 here -

At a first glance, this result seems to differ from the previous one (see section 4). However, it has to be noticed that the findings reported in section 4 have been obtained in a static context, applying a different technique on the whole set of individual choices, without distinguishing between full or partial tax evasion. Even in a static context though, when we restrict the analysis to individual full tax evasion decisions we get results showing that, vertical inequity exerts positive effect on full tax evasion[9]. Thus, such positive effect of vertical inequity on individual decisions on full tax evasion

[9] The test equality of proportions gives a p-value of 0.07 when comparing benchmark and horizontal inequity treatments and a p-value of 0.00 when comparing benchmark and vertical inequity treatments.

turns out to be a finding robust to changes in empirical techniques and size of dataset[10]. On the contrary in both contexts, the effect of horizontal inequity is not significant. Looking only at individual full evasion decisions, the behaviour of subjects in the vertical inequity treatment may be explained by equity theory (see Section 3.2) and, namely, Torgler (2002) suggesting that taxpayers perception of vertical and exchange inequity induces full tax evasion to restore equity. Unlike Torgler's paper, in our case, exchange equity is set to zero and, therefore, the role of vertical inequity seems to be enhanced. Though caution is needed, a tentative policy implication is that in order to prevent tax evasion, the decision-maker should pay specific attention to the vertical equity of the tax system.

6. 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, 2002; 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 run in a static and dynamic context. In a static context, considering any possible level of tax evasion, we show that equity considerations do not seem to change individual behaviour and, as a consequence, the levels of tax compliance across treatments remain almost constant. A possible explanation for such a result might on the fact that disregarding exchange equity is likely to lower the impact of inequity on taxpayer choices, generating fiscal illusion.

[10] The survival analysis has been run on 305 observations, whereas the test of equality of proportions on 600 observations.

However, looking at full tax evasion behaviour and applying estimation models suggested by survival analysis, 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. The same results can be found in a static context dealing with full tax evasion. Furthermore, there is a strong gender effect showing that female participants are less likely to report zero income independently of the inequity conditions they face.

Though caution is needed, a tentative policy implication is that in order to prevent tax evasion, the decision-maker should pay specific attention to the vertical equity of the tax system.

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Figure 1 - Tax compliance

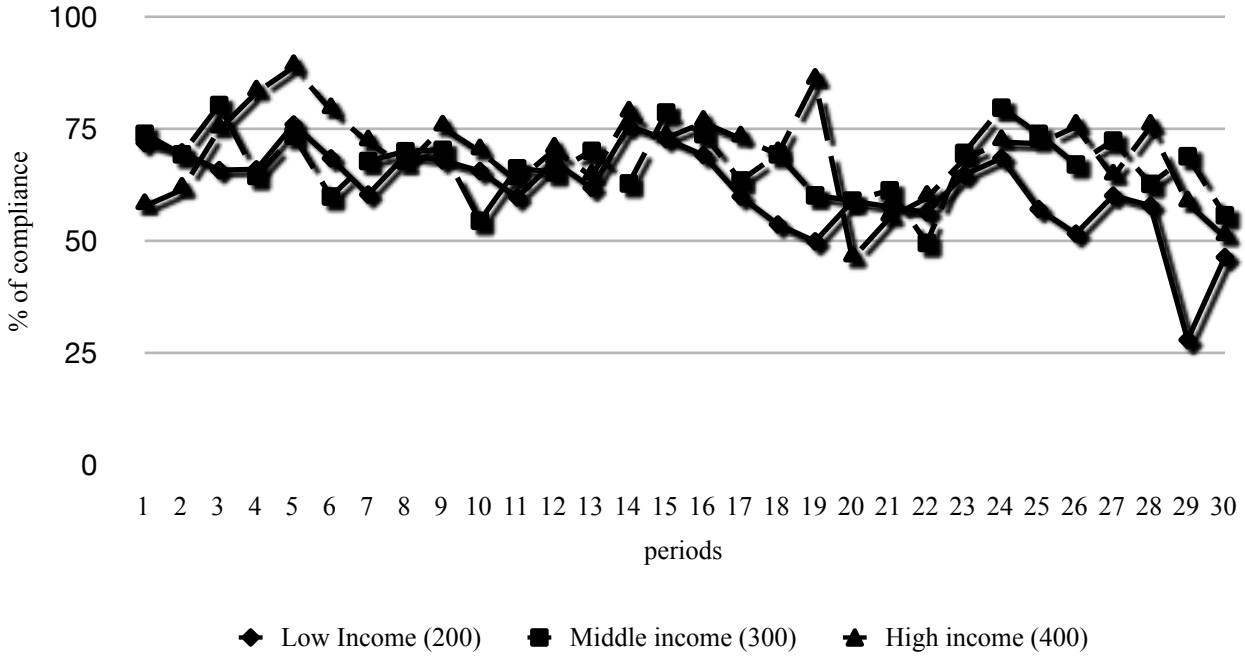


Table 1 - Average tax Compliance levels

	Full equity	Horizontal Ineq	Vertical Ineq	Av. by income
Low income	57.90	62.80	62.35	61.01
Middle income	65.68	66.70	68.67	67.01
High income	67.83	70.06	70.04	69.31
Av. by conditions	63.80	66.52	67.02	65.78

Table 2 - Equity vs. Horizontal inequity - Cox PH model for recurrent events

	Coefficient	Robust Std. Err.	z-Test	p-value	95% C.I.		Hazard Ratio
Treat	0.18	0.11	1.61	0.107	-0.04	0.41	1.20
Gender	-1.56***	0.43	-3.61	0.000	-2.40	-0.71	0.21
Degree	0.10	0.56	0.18	0.860	-1.00	1.20	1.10
Age	-0.21	0.05	-0.47	0.642	-0.11	0.07	0.98
Income	0.01	0.36	0.06	0.949	-0.49	0.52	1.01
Risk_Av	0.36	0.43	0.84	0.401	-0.48	1.19	1.43
Audit	0.19	0.44	0.43	0.668	-0.68	1.06	1.20
N° of subj.	120		Log Likehood	-844.02			
N° of failures	185		Wald test	20.83			
Time at risk	1198		Probability	0.004			

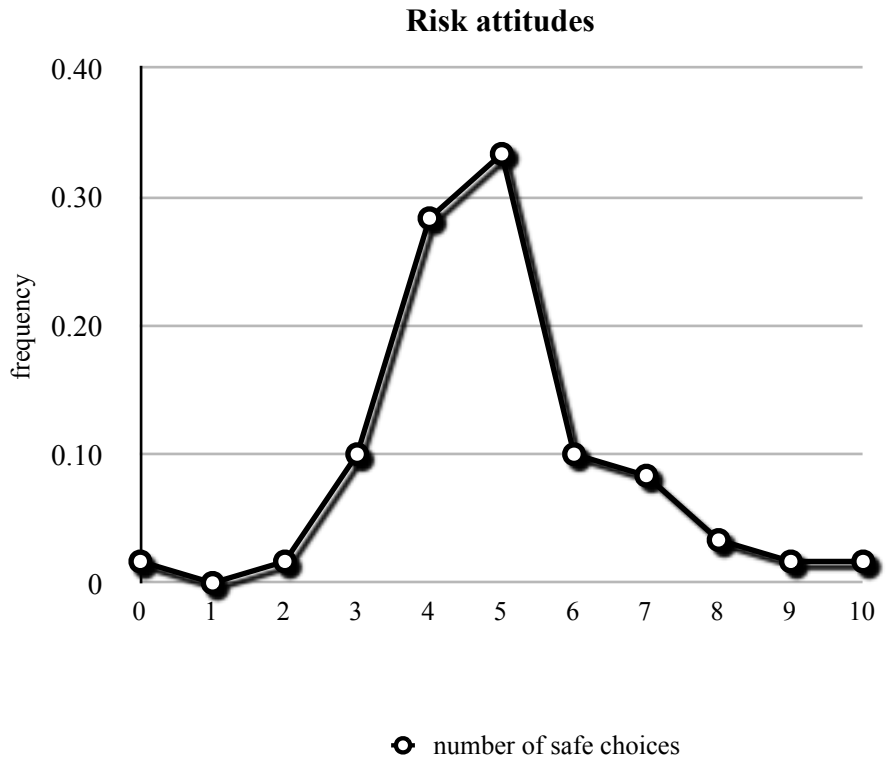
Note: Significance levels at 10%, 5%, and 1% are indicated by *, **, and ***, respectively
[a]ML estimates with robust standard errors.

Table 3 - Equity vs. Vertical inequity - Cox PH model for recurrent events

	Coefficient	Robust Std. Err.	z-Test	p-value	95% C.I.		Hazard Ratio
Treat	0.47***	0.15	3.17	0.002	0.18	0.76	1.60
Gender	-1.29***	0.39	-3.32	0.001	-2.05	-0.53	0.27
Degree	-0.17	0.50	-0.34	0.731	-1.15	0.81	0.84
Age	-0.04	0.04	-0.95	0.340	-0.12	0.04	0.96
Income	0.05	0.22	0.22	0.823	-0.38	0.48	1.05
Risk_Av	0.29	0.38	0.76	0.445	-0.45	1.02	1.33
Audit	0.08	0.14	0.57	0.566	-0.19	0.35	1.08
N° of subj.	120		Log Likehood	-1002.57			
N° of failures	219		Wald test	36.52			
Time at risk	1199		Probability	0.000			

Note: Significance levels at 10%, 5%, and 1% are indicated by *, **, and ***, respectively
[a]ML estimates with robust standard errors.

Appendix A


Risk attitudes
0.40
0.30
0.20
0.10
0
frequency
0
1
2
3
4
5
6
7
8
9
10
number of safe choices

Appendix B

Full Equity Conditions

	Earned incomes		
	200 CS	300 CS	400 CS
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%

Horizontal inequity and Vertical equity condition

	Earned incomes		
	200 CS	300 CS	400 CS
1	10%	18%	27%
2	12%	21%	33%
3	15%	26%	41%
4	10%	18%	27%
5	12%	21%	33%
6	15%	26%	41%
7	10%	18%	27%
8	12%	21%	33%
9	15%	26%	41%
10	10%	18%	27%
11	12%	21%	33%
12	15%	26%	41%
13	10%	18%	27%
14	12%	21%	33%
15	15%	26%	41%

Horizontal equity and Vertical inequity condition

	Earned incomes		
	200 CS	300 CS	400 CS
1	26%	26%	26%
2	26%	26%	26%
3	26%	26%	26%
4	26%	26%	26%
5	26%	26%	26%
6	26%	26%	26%
7	26%	26%	26%
8	26%	26%	26%
9	26%	26%	26%
10	26%	26%	26%
11	26%	26%	26%
12	26%	26%	26%
13	26%	26%	26%
14	26%	26%	26%
15	26%	26%	26%