The Runaway Taxpayer

Or: Is Prior Tax Notice Effective against Scofflaws?

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Abstract. In order to analyse the determinants of tax evasion, the existing literature on individual tax compliance typically takes a "prior-to-audit" point of view. This paper focuses on a "post-audit, post-detection" — so far unexplored — framework, by investigating what happens after tax evasion has been discovered and noncompliant taxpayers are asked to pay their debts. We first develop a two-period dynamic model of individual choice, considering an individual that has been already audited and detected as tax evader, who knows that Tax Authorities are looking for her to cash the due amount. We derive the optimal decision of running away in order to avoid paying the bill, and show that the experience of a prior tax notice reduces the probability to behave as a scofflaw. We then exploit information on "post-audit, post-detection" tax compliance provided by an Italian collection agency for the period 2004-2007 to empirically test the effectiveness of the prior notice against scofflaws. The evidence from alternative logit model specifications supports our theoretical prediction: experiencing a tax notice reduces the probability of running away by about 10%. However, this may prove to be insufficient to discourage some individuals to runaway in order to avoid paying their dues.

JEL Codes: D81; H26; H30; K42

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1 Introduction

Tax evasion is one of the most important problems that Tax Administrations need to tackle all around the world, but official statistics on tax frauds are difficult to obtain since tax evasion is typically unobserved. Estimates of the shadow economy provided, e.g., by Schneider and Enste (2000) suggest that the problem is huge in countries like Nigeria, Egypt, and Thailand, where the shadow economy represents about 70% of GDP on average during the period 1990-1993. The problem is relevant also in OECD Mediterranean countries (like Italy, Spain, and Greece) and in Belgium, where the equivalent figure over the same period amounts to 24-30% of GDP. The lowest estimates are referred to Switzerland, Japan, the United States and Austria, where the shadow economy still covers about 8-10% of GDP. Given the importance of the problem, it is not surprising that in the economic literature a large number of papers has been produced on the topic of tax evasion (see, e.g., the surveys in Cowell, 1990; Andreoni *et al.*, 1998; Slemrod and Yitzhaki; 2002). As for economic theory, the standard approach *à la* Allingham and Sandmo (1972) typically takes a "prior-to-audit" point of view, showing the responsiveness of tax evasion to variations in the tax-enforcement parameters, using a one-period expected utility model.[1] This basic approach has been extended to investigate the dynamics of tax compliance, considering current compliance as a function of past reports and audit experiences. But the findings on the responsiveness of the decision to evade taxes to past audit experiences do not lead to univocal conclusions. In fact, the update of beliefs about a future audit can lead either to an increase or to a decrease in compliance, depending on the degree of risk aversion (e.g., Snow and Warren, 2007). Also the empirical works based on this theoretical literature provide mixed results on the impact of tax-enforcement efforts on compliance. In particular, the findings of the few papers based on actual evasion data partially conflict with the larger literature based on laboratory experiments (e.g., Erard, 1992; Bergman and Nevarez, 2006).

However, what is missing in the current literature is what happens *after* tax cheaters have been discovered: Are Tax Authorities really able to cash the due amounts? Difficulties to obtain reliable data on this stage are even more than those encountered for tax evasion. An almost unique source at the global level are the estimates of tax

[1] For an exhaustive and critical discussion of the main findings derived within the basic framework of tax compliance decisions, see the surveys by Cowell (2004) and Sandmo (2006).

arrears (i.e., 'all unpaid taxes, including those where a dispute is involved, for all years recorded on taxpayers' accounts') provided by the OECD, that seem to hint to a negative answer for the question posed above: in 2004, unpaid taxes were 51.3 % of net annual revenue collections in Portugal, 42.8% in Greece, 38.7% in Belgium (OECD, 2007)). Therefore, in these countries not only people evade taxes to a large extent, but they also do not seem to pay their debts *once their frauds have been detected*.

Besides OECD statistics, this inability to collect taxes surfaces from a variety of sources, hard to find, for different countries. A vivid example are the USA. According to Burman (2003), in a statement before the U.S. House of Representatives Committee on the Budget, «the IRS assesses almost $30 billion of taxes that *it will never collect*. This is not theoretical tax evasion. The $30 billion represents underpayments of tax that the IRS has identified but cannot collect because its staff is spread so thin. [...] According to IRS estimates, 60 percent of identified tax debts are never collected. These unclosed cases include: 75% of identified nonfilers; 79% of taxpayers who use "known abusive devices" to avoid taxes; 78% of taxpayers identified through document matching programs. It is possible that some of these people simply cannot afford to pay their tax debts, but more than half — 56% — of noncompliant taxpayers with incomes over $100,000 get off scot-free. It is demoralizing to honest taxpayers, and encouraging to tax scofflaws, that your odds are better than even of avoiding your tax bill, even if you are caught».

In this paper, we move a first step in trying to fill this gap in the literature by focusing on what happens *after* tax evasion has been discovered and noncompliant taxpayers are asked to pay their debts. Our contribution is twofold. We first develop a two-period dynamic model *à la* Allingham and Sandmo (1972) to analyze the "post-audit, post-detection" individual's choice problem on a peculiar action to be taken to avoid paying the tax bill, and study the impact of a previous tax notice on individual's compliance decision. In particular, we consider individuals who have already been detected by Tax Authorities as noncompliant and who can then decide to runaway, by "changing their address" in order to hide out and escape the notification by collection agents, thus avoiding to pay their bill (i.e., to behave as scofflaws). Looking at the data we obtained from an Italian collection agency, this is what happens in the real world for a considerable number of tax evaders. We then propose an empirical test based on real data, exploiting a sort of "natural experiment" on information dissemination by Tax Authorities about their enforcement efforts by means of the tax notice. We focus on Italy, a country where estimated tax evasion is high, Tax Code is complex, general reprobation among citizens due to tax evasion is low (e.g., Cannari and D'Alessio, 2007), and the collection system is inefficient. Not surprisingly, also the problem of cashing due (unpaid) taxes is large. According to available estimates provided by the Italian Agency for Internal Revenues (Agenzia delle Entrate), in 2007 only 1.57% of the total amount of taxpayers' rolls has been cashed by collection agencies. Moreover, taking for instance the 2000 Tax Year, only 8.73% of the outstanding debts have been cashed after eight years. The situation was even worst in the past, and it recently improved in 2005, with the institution of a state-owned corporation (Riscossione S.p.A.) in charge of the enforcement of the collection procedure through taxpayers' roll and tax notice. In line with the prediction of our theoretical model, the empirical analysis shows a clear negative effect (about 10%) of a previous tax notice on the probability of running away in the attempt to escape a subsequent tax notice. However, this may prove to be insufficient to discourage some individuals to runaway in order to avoid paying their dues.

The remainder of the paper is structured as follows. Section 2 provides essential background information on the tax collection procedure in Italy, with a particular emphasis on the collection of taxes by taxpayers' roll. In Section 3 we propose a simple and stylized model of individual choice to study how the taxpayer's decision of changing address in order to avoid paying the bill is affected by the presence of a prior notice. Section 4 presents the data and our empirical tests on the relationship between the probability of moving and the experience of a tax notice. Section 5 concludes and provides some policy suggestions for increasing the effectiveness of the tax collection procedure.

2 The collection of taxes by taxpayers' roll

In this section we briefly describe the institutional features characterizing the collection of taxes by taxpayers' roll and the tax notice procedure in Italy. With respect to self-taxation, these represent "extra-ordinary" ways of tax payment, which occur after an audit and a detection of fraud by Tax Authorities. According to the Italian Tax Code, audit and detection of frauds must happen within five to seven years from the fiscal year which the episode of tax cheating is referred to. These time limits usually correspond to the lag with which Tax Authorities effectively audit (and then *eventually* notice) taxpayers.

When — for some individuals — tax frauds have been discovered, Tax Authorities issue a tax roll, i.e., a list of taxpayers and of their due amounts including fees, interests and a collection agency's premium. The tax roll becomes a document of execution with the sign of the legal ownership of the Tax Authority that issued the roll. Notice also that the tax roll clearly includes all payments that are due to a Public Administration, e.g. income taxes and local taxes as well as other revenue receipts, like royalty rents, licence fees and administrative sanctions.

All the tax rolls issued by Tax Authorities are periodically sent to collection agencies in charge of collecting taxes in specific geographical areas on the basis of the taxpayers' residence. It is up to collection agencies *to notice* to each individual included in a tax roll the amount of taxes that are due (in other words, "to deliver the bill"). According to the Italian law, the notice must occur within a set time limit, that lies between one and three years according to the type of audit. This further increases the time lag between the initial decision to evade taxes and the time when Tax Authorities attempt at cashing due taxes.

The notice plays a crucial role in the collection procedure, because only *noticed* tax debts allow Tax Authorities to legally expropriate the taxpayer's assets whenever the taxpayer will not pay the due amount within the term of two months starting from the day of the notice. The most important problem of collection agencies is that in many cases the taxpayer is difficult to find or, in extreme cases, her address is unknown (because she hides out). Using the jargon of collection agencies, we talk here of the taxpayers "changing address". According to practitioners (and actual data, as we show in the empirical part of the paper), this is an important phenomenon: if the collection agency is not able to discover where the taxpayer hides, then the notice will not take place within the set time limit. Moreover, even if the law provides for the notice to occur without finding the taxpayer, its effectiveness is clearly flawed. Hence, hiding from Tax Authorities is a way to avoid fiscal obligations and to make ineffective the provisions of the Tax Code.

On the other hand, an individual to whom a tax return form has been noticed has two opportunities: she can pay or not the due amount to the collection agency within two months. If she pays, then her obligation comes to an end. Otherwise, she can appeal against the tax return form to the Tax Court, or she can simply decide not to pay, behaving as a scofflaw. If she decides not to pay, then the collection agency starts the enforcement within a year from the day of the notice, by expropriating taxpayer assets (if she clearly has some). In both cases, by receiving a notice the individual becomes aware of the enforcement efforts by Tax Authorities. The notice can then be interpreted as a "signal" of these enforcement efforts, which is likely to influence taxpayer's future compliance (like information on audits in, e.g., Alm *et al.*, 2009, and Gemmell and Ratto, 2012). Identifying this impact is our goal in the analysis to follow.

3 Modelling the behavior of tax scofflaws

We develop here a stylized model of the individual choice about whether attempting to escape the notification of a tax roll by changing address (or "running away"). Since our main focus is to highlight the impact of a previous notification on the decision about attempting to escape a subsequent notification, we build a simple two-period dynamic model in which the Tax Authorities issue two (successive) tax rolls to be notified to the taxpayer. The theoretical framework is based on the standard expected utility paradigm *à la* Allingham and Sandmo (1972), which is adapted to the case of a "post-audit, post-detection" situation that spans over two periods of time.

A tax cheater has evaded taxes twice in the past. The Tax Administration has detected both acts of misbehavior and it has issued two separate tax rolls that the tax-collection agency will try to notify at the tax evader's known address at different dates. The tax cheater is perfectly informed about this; therefore, we represent her problem as a two-stage decision tree, which is illustrated in Figure 1. In stage 1, the Agency attempts to notify the first tax roll, of amount $f_1 > 0$, which includes due taxes plus fines. Having anticipated the visit of the tax collector, the tax evader decides whether to hide by changing address ($h_1 = 1$), at a cost $c > 0$, or not to hide ($h_1 = 0$), in which case no cost is incurred. In the latter case, the tax roll is notified and the due amount is collected. Instead, if the taxpayer runs away, then with probability $1 - p$, $p \in (0, 1)$, she escapes notification and the payment of taxes and fines, whereas with probability p she is discovered and the due amount is collected.

Following the taxpayer's decision and the notification outcome in stage 1, there are three Decision Nodes in stage 2, which are labelled DN*, DN** and DN***. In all nodes, the agency tries to notify the second tax roll, of amount $f_2 > 0$, while the tax evader has again to take the choice of whether attempting ($h_2^{\mathrm{DN}} = 1$), or not attempting ($h_2^{\mathrm{DN}} = 0$), to escape the notification. Again, c is the cost of hiding and p

is the probability of notification for a running taxpayer.[2]

We assume that there is a large population of tax cheaters, each one characterized by the level of her gross income, $w > 0$, and the amounts of the tax rolls, f_1 and f_2. We also assume that the cost of hiding by changing address, c, as well as the detection probability, p, are the same for all individuals. To simplify the analysis, we also make the following assumption.

Assumption 1 *For all taxpayers: (i) $f_1 > c$ and $f_2 > c$; (ii) $w - 2c - f_1 - f_2 > 0$.*

Assumption 1(i) allows us to focus only on those individuals for whom it may be worth trying to escape the notification of the tax bills. In fact, it is never worth hiding by bearing a cost which is greater than the due fine. Assumption 1(ii) holds that the tax cheater has enough resources to pay for unsuccessful attempts to avoid the notification of both tax rolls. In fact, it is reasonable to think that gross income w bears a positive correlation with the level of tax evasion, which in turn is linked to the level of the due fines f_1 and f_2.

Let $T \subseteq \mathbf{R}^3_+$ be the (compact) set of taxpayers' types, satisfying Assumption 1, with $t = \{w, f_1, f_2\}$ a typical element of T. We normalize the population mass to unity and we denote with $\Phi(w, f_1, f_2)$ the cumulative distribution function of taxpayers' types.

We assume that all taxpayers have the same preferences over net income, x, which are represented by the cardinal utility function $u(x)$, and that preferences over lotteries are represented by a von Neumann-Morgenstern expected utility function. Concerning the function $u(x)$, we make the following assumptions.

Assumption 2 *The cardinal utility of net income, $u(x)$, is a three times continuously differentiable function, strictly increasing and strictly concave. Moreover, for any triplet*

[2] We assume that both the cost of hiding, c, and the probability of detection, p, are the same in stages 1 and 2. One could argue that a taxpayer opting for hiding in stage 1, and that escaped notification (hence moving from DN*** in stage 2), would incur a cost lower than c if opting to hide also in stage 2. Instead, we assume that she bears the full cost c also in this case, for the reason that this is the hypothesis which is less favorable to the theoretical prediction we are looking for, namely that a notification in stage 1 reduces the probability of hiding in stage 2. Notice also that we are assuming that the taxpayer knows in advance (in stage 1) that the tax collection agency will try to notify two tax rolls of amounts f_1 and f_2. More realistically, we could have assumed that the first tax roll is issued with certainty, while the second one is issued with probability $\pi < 1$. In this case, ex-ante (i.e., in stage 1) the issue of the second tax roll would be an uncertain event. However, this extension, while not affecting the results, would increase complexity.

of scalars $\{x_1, x_2, x_3\}$*, such that* $0 < x_1 < x_2 < x_3$*, the following inequality holds true:*

$$\frac{-\int_{x_2}^{x_3} u''(x)\,\mathrm{d}x}{\int_{x_2}^{x_3} u'(x)\,\mathrm{d}x} < \frac{-\int_{x_1}^{x_3} u''(x)\,\mathrm{d}x}{\int_{x_1}^{x_3} u'(x)\,\mathrm{d}x}. \tag{1}$$

In Assumption 2, we make the standard assumption that taxpayers are risk averse, i.e., $u''(x) < 0$, and that the more stringent condition (1) holds true. To interpret the latter, observe that strict concavity of the utility function implies that $\int_{x_2}^{x_3} u'(x)\,\mathrm{d}x < \int_{x_1}^{x_3} u'(x)\,\mathrm{d}x$. Hence, a necessary condition for inequality (1) to hold true is that $-\int_{x_2}^{x_3} u''(x)\,\mathrm{d}x < -\int_{x_1}^{x_3} u''(x)\,\mathrm{d}x$, which in turn holds true if and only if $u'''(x) > 0$. Therefore, a necessary condition for inequality (1) to hold true is that the marginal utility of income, $u'(x)$, is a sufficiently convex function of income.

Condition (1) is satisfied, for instance, by the widely used class of isoelastic utility functions, which exhibit constant relative risk aversion, and therefore also decreasing absolute risk aversion. Appendix A contains the formal proof.

Notice also that condition (1) bears some resemblance to the standard condition that the coefficient of absolute risk aversion, $-u''(x)/u'(x)$, is a decreasing function of income.[3] If the utility function $u(.)$ exhibits decreasing absolute risk aversion, then

$$\frac{\mathrm{d}(-u''(x)/u'(x))}{\mathrm{d}x} = -\frac{u'''u' - (u'')^2}{(u')^2} < 0.$$

For any triplet of scalars $\{x_1, x_2, x_3\}$, such that $0 < x_1 < x_2 < x_3$, the latter condition also implies that:

$$-\int_{x_2}^{x_3} \frac{u''(x)}{u'(x)}\,\mathrm{d}x < -\int_{x_1}^{x_3} \frac{u''(x)}{u'(x)}\,\mathrm{d}x. \tag{2}$$

Conditions (1) and (2) are similar but not equivalent. However, $u'''(x) > 0$ is a necessary condition for both inequalities to hold true.

Given the above assumptions, the problem of a typical taxpayer $t \in T$ is solved by backward induction. Therefore, we begin by analyzing the second stage.

3.1 The second tax roll

While the choice (hide/do not hide) is the same in all stage 2 decision nodes, the final outcome is different, since each node is contingent on a different decision/outcome in

[3] The coefficient of absolute risk aversion is usually employed to assess how changes of an exogenous variable affect the optimal (interior) solution of a continuous variable of choice. Since in our model the choice is discrete, we use a similar, but not equivalent, condition.

stage 1. In particular, if the taxpayer does not hide in stage 2, then her net income, contingent on the decision node DN $\in \{*, **, ***\}$, is equal to:

$$x_2^{\mathrm{DN}} = w^{\mathrm{DN}} - f_2,$$

where w^{DN} is equal to:

$$w^{***} = w - c, \quad \text{if the taxpayer hides and is not caught in stage 1,}$$

$$w^{**} = w - f_1, \quad \text{if the taxpayer does not hide in stage 1,}$$

$$w^{*} = w - c - f_1, \quad \text{if the taxpayer hides and is caught in stage 1.}$$

Note that, by Assumption 1(i):

$$w^{*} < w^{**} < w^{***}. \tag{3}$$

If the taxpayer hides in stage 2, and then she is caught, her final wealth is equal to:

$$x_1^{\mathrm{DN}} = w^{\mathrm{DN}} - c - f_2.$$

Finally, if the taxpayer hides in stage 2, and then she is not caught, her final wealth is equal to:

$$x_3^{\mathrm{DN}} = w^{\mathrm{DN}} - c.$$

We are now ready to examine the optimal taxpayer's choice at any given stage 2 decision node. Let $\mathrm{E}u^{\mathrm{DN}}$ be the *expected* utility of a taxpayer choosing to run away at stage 2 decision node DN, and let $\mathrm{C}u^{\mathrm{DN}}$ be the *certain* utility of a taxpayer choosing not to run away. At any given node DN, the taxpayer will change address if and only if $\mathrm{E}u^{\mathrm{DN}}$ is strictly greater than $\mathrm{C}u^{\mathrm{DN}}$, that is:

$$\mathrm{E}u^{\mathrm{DN}} \equiv (1-p)u(w^{\mathrm{DN}} - c) + pu(w^{\mathrm{DN}} - c - f_2) > u(w^{\mathrm{DN}} - f_2) \equiv \mathrm{C}u^{\mathrm{DN}}. \tag{4}$$

Condition (4) can be expressed in terms of an inequality between the objective probability of detection, p, and a type-specific probability, $\tilde{p}(.)$, which reads as follows:

$$p < \frac{u(w^{\mathrm{DN}} - c) - u(w^{\mathrm{DN}} - f_2)}{u(w^{\mathrm{DN}} - c) - u(w^{\mathrm{DN}} - c - f_2)} \equiv \tilde{p}(w^{\mathrm{DN}}, c, f_2) \equiv \tilde{p}^{\mathrm{DN}}. \tag{5}$$

Condition (5) says that taxpayers for whom $\tilde{p}^{\mathrm{DN}} > p$ will hide at stage 2 decision node DN, while those for whom $\tilde{p}^{\mathrm{DN}} \leq p$ will not hide. Notice that, by Assumption 1(i), $\tilde{p}^{\mathrm{DN}} < 1$.

A central result of the paper is contained in the following lemma.

Lemma 1 *For all $0 < c < f_2$, the probability thresholds, $\tilde{p}^*$, $\tilde{p}^{**}$, and $\tilde{p}^{***}$, defined in Eq. (5), are such that:*

$$\tilde{p}(w^*, c, f_2) < \tilde{p}(w^{**}, c, f_2) < \tilde{p}(w^{***}, c, f_2), \tag{6}$$

if and only if condition (1) given in Assumption 2 holds true.

Proof. By Eq. (3), $w^* < w^{**} < w^{***}$. Hence, inequalities (6) hold true if and only if $\partial \tilde{p}_2/\partial w^{\mathrm{DN}} > 0$, for all $0 < c < f_2$. By differentiating $\tilde{p}_2$ in Eq. (5) with respect to w^{DN}, we get:

$$\frac{\partial \tilde{p}^{\mathrm{DN}}}{\partial w^{\mathrm{DN}}} = \frac{u'(w^{\mathrm{DN}} - c) - u'(w^{\mathrm{DN}} - f_2)}{u(w^{\mathrm{DN}} - c) - u(w^{\mathrm{DN}} - c - f_2)} - \frac{u'(w^{\mathrm{DN}} - c) - u'(w^{\mathrm{DN}} - c - f_2)}{u(w^{\mathrm{DN}} - c) - u(w^{\mathrm{DN}} - c - f_2)}\tilde{p}^{\mathrm{DN}}. \tag{7}$$

Let $x_1 = w^{\mathrm{DN}} - c - f_2$, $x_2 = w^{\mathrm{DN}} - f_2$, $x_3 = w^{\mathrm{DN}} - c$, $x_1 < x_2 < x_3$. Substituting for $\tilde{p}^{\mathrm{DN}}$ into Eq. (7), the condition $\partial \tilde{p}_2^{\mathrm{DN}}/\partial w^{\mathrm{DN}} > 0$ can be written as:

$$-\frac{u'(x_3) - u'(x_2)}{u(x_3) - u(x_2)} < -\frac{u'(x_3) - u'(x_1)}{u(x_3) - u(x_1)},$$

which is equivalent to condition (1) given in Assumption 2. Condition (1) also implies that $\partial \tilde{p}^{\mathrm{DN}}/\partial w^{\mathrm{DN}} > 0$, for all $0 < c < f_2$. Hence condition (1) is both necessary and sufficient for the inequalities (6) to hold true. ■

By Lemma 1, the set T of taxpayers' types can be divided into four disjoint subsets, which are defined as follows:

$$\begin{aligned}
T_{000} &= \{t \in T | \, \tilde{p}^* < \tilde{p}^{**} < \tilde{p}^{***} \leq p\}, \quad \text{i.e., } h_2^* = 0,\, h_2^{**} = 0,\, h_2^{***} = 0, \\
T_{001} &= \{t \in T | \, \tilde{p}^* < \tilde{p}^{**} \leq p < \tilde{p}^{***}\}, \quad \text{i.e., } h_2^* = 0,\, h_2^{**} = 0,\, h_2^{***} = 1, \\
T_{011} &= \{t \in T | \, \tilde{p}^* \leq p < \tilde{p}^{**} < \tilde{p}^{***}\}, \quad \text{i.e., } h_2^* = 0,\, h_2^{**} = 1,\, h_2^{***} = 1, \\
T_{111} &= \{t \in T | \, p < \tilde{p}^* < \tilde{p}^{**} < \tilde{p}^{***}\}, \quad \text{i.e., } h_2^* = 1,\, h_2^{**} = 1,\, h_2^{***} = 1.
\end{aligned}$$

For instance, taxpayers belonging to the subset T_{011} are those not hiding at node DN* but hiding at both nodes DN** and DN***.

Let

$$n_j = \iiint_{t \in T_j} \mathrm{d}\Phi(w, f_1, f_2), \qquad j \in J = \{000, 001, 011, 111\}, \tag{8}$$

be the mass of taxpayers belonging to subset T_j, $j \in J$, defined above. By construction, $\sum_{j \in J} n_j = 1$.

3.2 The first tax roll

We now turn to the taxpayer's decision at stage 1. If the taxpayer chooses to hide in stage 1, and taking into account her optimal choices at stage 2 nodes DN*** and DN*, her expected utility is equal to:

$$\mathrm{E}u(h_1 = 1) = (1-p)\max\left\{\mathrm{E}u^{***}, \mathrm{C}u^{***}\right\} + p\max\left\{\mathrm{E}u^{*}, \mathrm{C}u^{*}\right\},$$

where $\mathrm{E}u^{\mathrm{DN}}$ and $\mathrm{C}u^{\mathrm{DN}}$ are defined in Eq. (4). If, instead, the taxpayer chooses not to hide in stage 1, her expected utility is equal to:

$$\mathrm{E}u(h_1 = 0) = \max\left\{\mathrm{E}u^{**}, \mathrm{C}u^{**}\right\}.$$

Hence, the taxpayer will run away in stage 1 if and only if $\mathrm{E}u(h_1 = 1) > \mathrm{E}u(h_1 = 0)$.

Denote with q_j, $j \in J$, the share of taxpayers belonging to subgroup T_j that opt for hiding at stage 1. The total mass of taxpayers hiding at stage 1, i.e., the probability that a generic taxpayer $t \in T$ chooses $h_1 = 1$ at stage 1, is therefore equal to:

$$\Pr(h_1 = 1) = \sum_{j \in J} n_j q_j = n_{000}q_{000} + n_{001}q_{001} + n_{011}q_{011} + n_{111}q_{111}. \tag{9}$$

3.3 Probabilities of hiding at stage 2 decision nodes

By combining the population shares n_j and q_j, we can finally define the probability that a generic taxpayer called to take a decision at stage 2 node DN will opt for hiding away from the tax authority. Consider, for instance, node DN***. The taxpayers that choose $h_2^{***} = 1$ are those belonging to the subsets T_k, of mass n_k, $k \in \{001, 011, 111\}$. A fraction $(1-p)q_k$ of the taxpayers belonging to these subsets have chosen to hide at stage 1 ($h_1 = 1$) and have subsequently escaped notification (recall that the probability of notification, p, is type independent). Therefore, the probability that a generic taxpayer taking a decision at node DN*** opts for hiding is equal to:

$$\Pr(\,h_2^{***} = 1|\,h_1 = 1 \text{ and not notified}) = \frac{n_{001}q_{001} + n_{011}q_{011} + n_{111}q_{111}}{\Pr(h_1 = 1)}. \tag{10}$$

Similarly, the probability that a generic taxpayer taking a decision at node DN* opts for hiding is equal to:

$$\Pr(\,h_2^{*} = 1|\,h_1 = 1 \text{ and notified}) = \frac{n_{111}q_{111}}{\Pr(h_1 = 1)}. \tag{11}$$

Finally, the probability that a generic taxpayer taking a decision at node DN** opts for hiding is equal to:

$$\Pr(h_2^{**} = 1 |\, h_1 = 0, \text{ notified}) = \frac{n_{011}(1 - q_{011}) + n_{111}(1 - q_{111})}{1 - \Pr(h_1 = 1)}. \tag{12}$$

The following proposition states the main result by comparing the probabilities (10)–(12) defined above.

Proposition 1 *The ranking of the probabilities of hiding at the stage 2 decision nodes is as follows:*

- $\Pr(h_2^{***} = 1 |\, h_1 = 1 \text{ and not notified}) > \Pr(h_2^{*} = 1 |\, h_1 = 1 \text{ and notified})$*.*
- $\Pr(h_2^{*} = 1 |\, h_1 = 1 \text{ and notified}) > \Pr(h_2^{**} = 1 |\, h_1 = 0, \text{ notified})$ *if and only if*

$$q_{111} > \Pr(h_1 = 1)\left(1 + \frac{n_{011}(1 - q_{011})}{n_{111}}\right). \tag{13}$$

Proof. Both statements immediately follow by comparing Eq. (10) with Eq. (11), and Eq. (11) with Eq. (12), respectively. ■

Proposition 1 shows that taxpayers that do not succeed in running away in stage 1 are *less likely* to run away also in stage 2 than taxpayers that escape the tax notice in stage 1. In other terms, and taking stage 2 as a reference point, the experience of a prior tax notice reduces the probability that a generic taxpayer attempts to escape the current tax notice. This is exactly the main relationship which is tested in the following empirical section. The intuition of the result is simple. Taxpayers that unsuccessfully attempt to escape the tax notice in stage 1 suffer a negative income effect, compared to taxpayers that successfully run away, since the former bear both the cost of changing address and the cost of paying due taxes plus fines, while the latter bear only the cost of changing address. Given that, by Assumption 2, a negative income effect makes individuals less prone to take risks, some of the unsuccessful stage 1 scofflaws rationally decide not to take chances in stage 2.

Proposition 1 also shows that taxpayers that do not run away in stage 1 are *less likely* to run away in stage 2 than taxpayers that behave as scofflaws in stage 1, provided that inequality (13) is satisfied. Although it is not possible to characterize in analytical terms the conditions under which inequality (13) holds true, informal arguments based on economic intuition suggest that the inequality should hold true in most relevant cases. In particular, it is reasonable to expect that both $q_{111} > \Pr(h_1 = 1)$ and

$n_{011} < n_{111}$, in which case inequality (13) is likely to hold true. As for the former inequality, the claim is that the probability q_{111} that taxpayers belonging to the subset T_{111} (i.e., those running away at all stage 2 decision nodes) run away in stage 1 is greater than the corresponding weighted probability $\Pr(h_1 = 1)$, defined in Eq. (9), referred to the entire population, which refers also to the subsets of taxpayers that do not run away in at least one of stage 2 decision nodes (in particular, it is reasonable to expect that $q_{111} > q_{000}$, i.e., taxpayers running away at all stage 2 decision nodes are more likely to run away in stage 1 than taxpayers never running away in stage 2). As for the second claim, i.e., $n_{011} < n_{111}$, it is reasonable to expect that while n_{111} and n_{000} take 'large' values, n_{011} and n_{001} take instead 'small' values (recall that $\sum_{j \in J} n_j = 1$), since the majority of taxpayers is likely to take the same action at all stage 2 decision nodes. This is the case whenever the chain of inequalities shown in Eq. (6) is composed of probabilities $\tilde{p}^{\mathrm{DN}}$ which are 'close' to each other, as when gross income and fines show a significant positive correlation. In order to provide additional support to these informal arguments, Appendix A presents some numerical simulations of the model, showing that the ranking of the probabilities given in Proposition 1 holds true.

Before moving to the empirical section of the paper — where we provide first evidence on the impact of a previous tax notice on the probability of trying to escape a subsequent tax notice — two final remarks are in order. The first concerns the type of impact we are able to disentangle in practice. In our empirical specification, see Eq. (14) below, the probability of running away by changing address is conditioned only on a previous notification of a tax roll, and not on previous decisions about address changes. In terms of our theoretical model, see Figure 1, this means that the comparison we make with the empirical model is between the probability of running away by taxpayers moving from stage 2 decision node DN*** and the pooled group of taxpayers moving from decision nodes DN* and DN**. Distinguishing the two latter groups of taxpayers would require both a more general theoretical model (i.e., a model with more than two stages) and a dynamic empirical model, in which the probability of changing address in the current period is a function of address changes sometime in the previous periods.

The second remark concerns the assumption of taking as exogenously given the original tax evasion decision, which is implicit in our theoretical framework. Indeed, if the taxpayer is assumed to be forward looking, the details of the notification process are likely to have an influence also on the original evasion decision. For a given evasion level, an increase in the probability of notification reduces the expected utility from evasion (even after the taxpayer adjusts, if necessary, her changing address decision). Then, as a first reaction, a risk-averse taxpayer might reduce the level of tax evasion, which then in turn might decrease the probability of hiding to escape notification (because, for instance, the costs of hiding are now greater than the due fine; see Assumption 1 above). However, given the substantial time lag for the audit and detection by Tax Authorities to occur with respect to the year of original evasion decision (at least five to seven years), this argument does not seem to pose a serious problem both for our theoretical argument and — most importantly — for our empirical test, to which now we turn.

4 Testing the impact of a prior tax notice

4.1 Data and variables

For our empirical test, we exploit information on individual "post-audit, post-detection" tax compliance files from seven distinct datasets referring to well-developed small- and medium-sized provinces located in Northern Italy (Aosta, Belluno, Mantova, Modena, Pordenone, Trento, and Treviso), including both residents and non-residents individuals. Since these provinces are similar in terms of per-capita income and demographic characteristics, but differ somewhat as for their historical-cultural background and political orientation, we consider separately the two samples of residents and non-residents.[4] Notice that relying on datasets concerning different social contexts for assessing the effect of tax notice experience on scofflaws' behavior allows us to check the robustness of our results with respect to sample perturbations.[5]

All data have been provided by the same agency (Uniriscossione S.p.A.), which was the sole responsible for the enforcement of tax collection in all the seven provinces, and refer to the universe of tax rolls issued in these provinces during the period 2004-2007. The data provide information on individuals that (at least once) decided not to regularly pay their taxes (or other revenue receipts) in the past, largely before 2004, and were audited and detected by Tax Authorities. The complete dataset includes

[4] On the contrary, we eliminated from the original samples all individuals for whom the place of residence is unknown. The main findings presented here are not affected by this procedure. Estimation results based on the whole samples are available from the authors upon request.

[5] Indeed, political ideology and cultural framework are likely to influence tax evasion behaviour; see, e.g., Cannari and D'Alessio (2007) for a discussion based on survey data.

about 250,000 observations: as for residents, we have 10,090 total observations for the Aosta sample, 4,187 for Belluno, 24,078 for Mantova, 64,975 for Modena, 13,527 for Pordenone, 18,575 for Trento, and 33,356 for Treviso; as for non-residents, we have 5,707 total observations for the Aosta sample, 2,923 for Belluno, 8,675 for Mantova, 24,622 for Modena, 6,117 for Pordenone, 9,270 for Trento, and 20,444 for Treviso.

The original data unit is the individual's tax return form. As described in Section 2, the rolls periodically issued by Tax Authorities are sent to the collection agency, so that the latter registers the amount due by each individual for a given period in a tax return form. For each individual's tax return form, our data include information on: the gender and the age of the tax evader; the Municipality (if the individual is Italian) or the State (for foreigners) where the tax evader was born; her residence address (that allows us to distinguish the two samples of residents and non-residents); eventual address changes with respect to the previous tax return form; the presence of a previous tax return form successfully notified, from 2004 onwards; the taxpayers' due amount.

From these original data, we defined the variables to be used in our empirical models. In particular, our dependent variable is Prob_ADCHANGE, a dummy variable which takes value one when the individual changed her address with respect to the previous tax return form.[6] Starting from a previous tax return form successfully notified, we build our main independent variable, NOT, a dummy variable which takes value one when the individual experienced a prior tax notice.[7] We also control for the taxpayers' due amount. Unfortunately, available information is relative only to the whole due amount of each tax return form, accrued to each individual in the period which the form refers to, but not to the "category" of taxes cheated. These include evaded taxes plus penalties, as well as other non-tax debts — such as royalty rents, fines for traffic violations and licence fees. Given the absence of any information on the "category" of taxes cheated, to provide a rough control for this we clustered the total due amount into four classes and defined a dummy variable for each class (TAX1, TAX2, TAX3, TAX4, from less than 100 euro to more than 50,000 euro). Fees and fines usually fall in the lowest classes, while taxes are more likely to be found in the highest

[6] It is worth highlighting that the collection agency has an incentive to search for taxpayers, since it receives a fixed price for each notified tax debt. Hence the number of address changes is not affected by an opportunistic behaviour of the collection agency.

[7] It is worth mentioning that the tax notice has been experienced from 2004 onwards, hence the original tax evasion decision is referred to at least five to seven years before.

ones. Finally, in order to take into account residual heterogeneity across scofflaws — which could affect their decision to move — we include in the estimated models control variables for some cultural factors highlighted by the literature to be important in influencing tax compliance — like gender, age, and the birth place — considering the variables FEM (a dummy for females); AGE1 to AGE5 (a set of dummies for age, from individuals between 18 and 25 years old to individuals more than 65 years old); a rich set of dummies for the birthplace (including four Italian macro-areas, and nine world zones). Additional controls for unobserved heterogeneity stemming from differences in taxpayer's socio-economic conditions (like income or the type of occupation) exploits the panel structure of the data, considering a FIXED EFFECTS (FE) specification of the empirical model. This is also a rough control for the "attitude" to move, which may have influenced the decision to run away in the past.

Table 1 lists all the variables used in the empirical analysis, together with their corresponding definitions. Descriptive statistics for the main variables used in our empirical exercise, distinguishing between the two samples of residents and non-residents, and each province separately, are in Table 2, while statistics for the remaining variables are in Table B.1 in Appendix B. The probability of address change and of having received a prior notice are clearly different between residents and non-residents. Considering the pooled samples, 53.6% of resident individuals changed their addresses, compared with only 35.7% of non-residents. The corresponding means for the variable NOT are 14.2% and 7.4%, respectively. We do not observe large differences across provinces with respect to these averages. As for residents, Prob_ADCHANGE ranges from 51.2% in the case of Modena to 60.3% in the case of Aosta, while NOT goes from 9.7% for Aosta to 16.3% for Treviso. As for non-residents, Prob_ADCHANGE ranges from 31.2% in the case of Belluno to 38.8% in the case of Modena, while NOT goes from 5.2% for Belluno to 9% for Treviso. Despite these differences, the distribution of the amount of due taxes is somewhat similar across the two samples: in about one fifth of the tax return forms the due amount is lower than 100 euro, for both residents and non-residents. The large majority of tax forms (about 60%) refers to amounts between 100 euro and 2,000 euro. Less than one percent of observations are relative to amounts above 50,000 euro. Also demographic characteristics of the two samples are pretty much similar: most of the individuals are males (about 80%), half of which are between 35 and 50 years old.

4.2 Estimation strategy

Starting from the theoretical model described in Section 3, we investigate the taxpayer's choice of running away to escape the effects of a tax notice by estimating different LOGIT model specifications. Our dependent variable Prob_ADCHANGE is measured here by the probability of changing residence address, which is assumed to be idiosyncratic to each scofflaw. The POOLED specification of the LOGIT model is represented by the following equation:

$$(\text{Prob\_ADCHANGE}_i = 1|\, \mathbf{z}_i) = F\left(\alpha + \beta\,\text{NOT}_i + \sum_{j=1}^{4} \delta_j \text{TAXj}_i + \sum_k \phi_k X_{ki}\right), \quad (14)$$

where the dependent, NOT and TAXj variables are defined as before; $\mathbf{z}_i$ is the vector of explicative factors for the decision to runaway; $F(.)$ is the Logistic CDF; finally, X_{ki} are the elements of $\mathbf{X}_i$, the vector of demographic controls (including dummies for gender, age, and the birth place) which provide a rough control for heterogeneity across scofflaws, including also cultural differences with respect to tax compliance. To explicitly allow for unobserved individual heterogeneity, we also estimate Eq. (14) with a *panel* specification including individual fixed effects. Such a FE LOGIT specification helps us to clear the impact of the prior notice on the probability to move from the effects of important taxpayer's characteristics, like gross income level, the type of job (e.g., public sector employees, self-employed workers, etc.), or the "attitude" to move, which could influence both the upstream opportunity to evade and the subsequent decision of moving.[8]

Notice that running FE LOGIT estimations helps to mitigate also the biases due to potential endogeneity problems affecting our key variable NOT. Indeed, as NOT reflects something like the past interaction of tax evaders with Tax Authorities, this variable might be correlated with past individual decision to evade taxes. Given that someone who was prepared to evade taxes in the past is also more likely to cheat Tax Authorities now, both our dependent variable and NOT will be correlated with unobserved characteristics of the individual that make her more/less prone to evade taxes.

An additional (and connected) problem which could bias our results is due to the potential influence of NOT on the ex-ante amount of taxes evaded. However, as we

[8] For reasons of taxpayer's privacy, this information about individual socio-economic attributes has not been released by the collection agency. The inclusion of individual fixed effects permits also to take into account individual-specific costs of moving, which cannot be measured directly.

already observed, given the relevant time lag with which Tax Authorities effectively audit (from five to seven years) and then notice (from one to three years) taxpayers and the four-years span of our dataset, all the tax forms observed in our sample include evaded amounts which have *not* been affected by any of the tax notices observed in the same sample.

As a final robustness check, we estimate the FE version of the LOGIT model (14) separately for the sub-samples of males and females. This allows us to control for potential sample selection biases in our results. Indeed, as suggested by the household and labour economics literature, females are usually less likely to take "extreme" choices — such as, for instance, evade taxes or running away — and this result could turn out in samples with female groups inflated by worse scofflaw behaviors compared to the male ones.

4.3 Results

Estimates of Eq. (14) on the samples of residents and non-residents individuals (reported in Appendix B, from Table B.2 to Table B.7) offer a consistent picture — both across provinces and alternative model specifications — of scofflaws' behavior in terms of the decision to run away in order to escape the tax notice. All the estimations consider as a reference individual a taxpayer that did not receive any prior notice (NOT = 0) and with a due amount above 50,000 euro (TAX4 = 1).[9]

A first clear result emerging from our exercises is that residents and non-residents are completely different individuals. Wald tests strongly confirm model validity for the sample of residents only. Indeed, for non-residents, while Wald tests on the POOLED specification are apparently confirming model validity, Wald tests on the FE specification strongly reject our model. All the coefficients, but for some demographic controls in the POOLED specifications, are statistically insignificant at the usual conventional levels. A likely interpretation is that non-residents are a bunch of highly heterogeneous taxpayers, in terms of where they currently live, and the motivations for changing their addresses (e.g., they moved simply because they changed their job). In what follows, we then concentrate on the sample of resident individuals only.

Table 3 presents coefficient and marginal effect estimates for NOT, for all the

[9]In the POOLED specification of LOGIT model, including also age and gender dummies, we have assumed the reference scofflaw to have an age between 18 and 25 (AGE1 = 1) and to be male (FEM = 0).

provinces and all our models. The impact is consistently negative and statistically significant across all the specifications, including POOLED and FE LOGIT models.[10] This indicates that the presence of a *prior notice* reduces the probability of changing address, exerting a deterrent role similar to that of a *prior audit* highlighted by part of the empirical literature based on both laboratory experiments (e.g., Spicer and Hero, 1985; Webley, 1987; Alm *et al.*, 2009) and real data (e.g., Bergman and Nevarez, 2006; Gemmell and Ratto, 2012). The magnitude of the marginal effects is also very similar across the different provinces and the different models, with most of the estimates around a 10% reduction in the probability of running away in order to escape the notice, and somewhat higher for just two provinces only (Treviso, −17%, and Belluno, −23%). This result suggests that scofflaws' reaction to the enforcement efforts by Tax Authorities is independent from the specific geographical context where the individuals live. Comparing the male-only and female-only sub-samples, we find that the impact of prior notice is higher for females than for males, in five out of seven provinces, with Trento and Treviso being the only exceptions. Since the individuals belonging to our datasets are extracted from the population of tax evaders, it is difficult to advance any specific interpretation for gender differences in behavior.

To better study the impact of the prior notice on Prob_ADCHANGE, we further estimated average predicted probabilities from the POOLED LOGIT model (Table 4), considering also the role of the due amount and of demographic variables.[11] Results from this additional exercise confirm the view that the prior notice exerts a sizable impact on the probability to runaway in order to escape notice, with the effect consistent across different provinces, different amounts, and different ages. First, considering the averages across all individuals in the provincial samples, the probability of changing address without having received a previous notice is between 53% and 61%, and reduces

[10] The robustness of our estimates after including individual fixed effects strongly suggests that the potential problem of endogeneity of NOT, as well as of TAX1-TAX4 discussed below, is not a major issue here. Indeed, as we already remarked, the long lag with which the notice usually occurs makes our regressors truly exogenous. Notice that the number of total observations available for each province significantly reduces when running FE LOGIT models, since all the individuals with only one tax return form have been dropped due to the inability of estimating the individual-specific fixed effect in these cases.

[11] For the sake of brevity, we do not report here birth zone effects. Notice, however, that these variables are almost always negative, suggesting that individuals borne in places different from where they actually live are probably less familiar with the social and economic context, and hence they run away less.

to between 52% and 38%. Most of the estimated impacts of NOT are around 10-12%, but for Belluno (23%) and Treviso (17%). In most cases (but for Aosta), the probability of running away to escape notice is below the 50% threshold, somewhat suggesting that the notice is able to deter individuals from running away. Second, we do not find a clear pattern for the impact of notice across the different classes of the due amount of taxes. Only in the case of Belluno (and, to some extent, Aosta), the predicted probability of changing address is clearly increasing in the level of tax debt, both considering NOT = 0 and NOT = 1. In the remaining provinces, we find the opposite trend, or a constant probability of moving across different classes. However, the estimated reduction in the probability of moving is remarkably similar, for amounts of less than 100 euro to tax debts of more than 50,000 euro. Again, Belluno is an exception, since we observe a 4 percentage points reduction in the estimated impact of NOT for TAX4 with respect to the other classes, which is consistent with expectations. Notice that, in this case, the probability of running away after having received a prior notice is still 62% (from 80%), suggesting that NOT is likely to be *ineffective* in deterring individuals from changing address to escape notice. Third, females are characterized by a higher probability of moving than males in all provinces, both considering an individual without a prior notice and an individual with a prior notice. As discussed above, this evidence might be due to a sample selection bias, since individuals included here are mostly tax cheaters. It is worth pointing out that the estimated impact of NOT is, however, largely confirmed on both sub-samples. Finally, considering age, we observe a large increase in the probability of running away when age increases, which is consistent across different provinces. Despite the deterrent effect of NOT, aged individuals in our samples are characterized by a larger probability of moving with respect to sample averages. In the case of Aosta, for instance, predicted probabilities for those older than 65 (AGE5) are 68% and 58% respectively, again suggesting that notice is likely to be ineffective in deterring illegal behaviors. Notice that the probability of running away is larger than 50% in all provinces for individuals in the AGE5 class.

On the whole, our empirical test on the effectiveness of prior tax notice suggests that, for most individuals, the experience of a notice goes in the right direction and significantly reduces the probability of running away. However, some individuals, still prefer to change address and avoid paying the bill. This evidence points toward an hysteresis in the illegal behavior of tax evaders, with prior notice mostly ineffective against some scofflaws. Our findings can help to explain the inability of tax collection agencies in cashing due amounts from noncompliant taxpayers observed in the real world: according to the latest estimates provided by the Agency for Internal Revenues (Agenzia delle Entrate), in Italy, only 1.57% of the total amount on taxpayers' rolls has been cashed in 2007; but the same is true also in the US, where about 60% of identified tax debts are never collected (Burman, 2003). Moreover, the evidence of weak prior tax notice effectiveness is also consistent with the results by Bergman and Nevarez (2006) on VAT audit enforcement in Chile and Argentina: even if tax audits seem to exert a discouraging impact towards those more prone to compliance, they have the undesired effect of furthering non-compliance among strong cheaters, who again exhibit an hysteresis in their illegal behavior that enforcement activity is not able to stop.

5 Conclusions

In this paper we study whether the experience of a tax notice affects individual future compliance behavior after having being detected as a cheater. Differently from previous literature on tax evasion decision, we focus here on a "post-audit, post-detection" context, i.e., a framework in which taxpayers have been already detected by Tax Authorities as noncompliant and they can decide to runaway in order to escape the notice and avoid paying their tax debt, behaving as scofflaws. The problem is substantial for at least two reasons: first, only a small percentage of the total amount of due taxes on taxpayers' rolls is actually cashed by collection agencies every year; second, available information indicates that in many cases the taxpayer's address is unknown, and a considerable number of individuals change residence address several times so as to avoid tax notice consequences.

We first provide a theoretical framework, by proposing a two-period dynamic model *à la* Allingham and Sandmo (1972) to explain the individual choice of running away. We show that, for risk averse individuals, a prior tax notice is likely to reduce the probability of attempting to escape a subsequent tax notice by changing address. The empirical analysis — which is based on real data provided by an Italian tax collection agency — highlights that experiencing a tax notice impacts negatively on the probability of changing address. However, for some individuals, this deterrent effect is not enough to discourage them from running away in order to avoid paying their dues. This implies that the experience of a tax notice is *potentially* able to reduce the decision to move, but the "power" of the signal on the enforcement efforts by Tax Authorities (implicit in the notice) can be insufficient to correct the individual incentive to escape Tax Authorities.

Our conclusions can help to draw some policy recommendations in order to increase the percentage of total evaded taxes cashed by collection agencies. Prior tax notice seems to be ineffective in discouraging non-compliance in some cases, so that the "power" of the signal should be strengthened, for instance by setting a shorter period within which the enforcement procedure may be applied, and by publishing the names of tax evaders with a high number of "address changes" and large unresolved liabilities. Moreover, it could be worth increasing also monetary burdens for scofflaws, e.g., by imposing a levy on tax evaders' bank account, as well as by making more difficult for them to get loans or to buy or sell real and financial assets. All these policies tend to increase the signal on the enforcement efforts via the tax notice.

Finally, our results suggest that future research on tax evasion should give more thoughts to the "post-detection, post-audit" procedures, as these appear to be as important as deterrence in influencing the impact of the illegal behavior of tax evasion on public finances. Discouraging and discovering tax cheating is just a first step, which lacks power if — at the end — governments are unable to really cash the due amounts.

Appendix A: Theoretical model

CRRA utility functions

Consider the class of isoelastic utility functions:

$$u(x) = \frac{x^{1-\rho}}{1-\rho}, \quad \rho > 0, \rho \neq 1, \tag{A.1}$$

where ρ represents the coefficient of relative risk aversion. It is immediate to see that $u'(x) = x^{-\rho} > 0$, $u''(x) = -\rho x^{-(1+\rho)} < 0$, $u'''(x) = \rho(1+\rho)x^{-(2+\rho)} > 0$.

Given the utility function (A.1), inequality (1) is written as:

$$\frac{x_3^{-\rho} - x_2^{-\rho}}{x_3^{1-\rho} - x_2^{1-\rho}} > \frac{x_3^{-\rho} - x_1^{-\rho}}{x_3^{1-\rho} - x_1^{1-\rho}}.$$

If $0 < \rho < 1$, the latter inequality can be written as:

$$-x_2^{-\rho}x_3^{1-\rho} - x_3^{-\rho}x_1^{1-\rho} + x_2^{-\rho}x_1^{1-\rho} > -x_1^{-\rho}x_3^{1-\rho} - x_3^{-\rho}x_2^{1-\rho} + x_1^{-\rho}x_2^{1-\rho}.$$

Simplifying we get:

$$\frac{x_3 - x_1}{x_3^{\rho}x_1^{\rho}} - \frac{x_3 - x_2}{x_3^{\rho}x_2^{\rho}} - \frac{x_2 - x_1}{x_2^{\rho}x_1^{\rho}} > 0.$$

The latter condition can then be written as:

$$x_2^{\rho}(x_3 - x_1) - x_3^{\rho}(x_2 - x_1) - x_1^{\rho}(x_3 - x_2) > 0.$$

Finally, by adding and subtracting $x_2^\rho(x_2 - x_1)$, the latter inequality can be written as:

$$\frac{x_2^\rho - x_1^\rho}{x_2 - x_1} > \frac{x_3^\rho - x_2^\rho}{x_3 - x_2},$$

which holds true if $0 < \rho < 1$. The proof for $\rho > 1$ is similar, and therefore it is omitted.

Numerical simulations

We provide a numerical simulation of the theoretical model by considering a population of 1,000 individuals. The utility function, identical for all individuals, is of the CRRA type defined in Eq. (A.1).[12] Gross income w is uniformly distributed on the closed interval $[w\_\min, w\_\max]$. The fines f_1 and f_2 are as follows:

$$\begin{aligned} f_1 &= a_1 w + (1 - a_1) y_1, \quad \text{where } a_1 \in [0,1], \, y_1 \text{ uniformly distributed on } [y_1\_\min, y_1\_\max], \\ f_2 &= a_2 w + (1 - a_2) y_2, \quad \text{where } a_2 \in [0,1], \, y_2 \text{ uniformly distributed on } [y_2\_\min, y_2\_\max]. \end{aligned}$$

Hence, $f_k\_\min = a_k w\_\min + (1 - a_k) y_k\_\min$, $f_k\_\max = a_k w\_\max + (1 - a_k) y_k\_\max$, $k = 1, 2$. If $a_1 > 0$ and $a_2 > 0$, then there is a positive correlation between gross income w and fines f_1 and f_2, which is reasonable to assume.

The results of the simulation of eight different specifications of the model are shown in Table A.1. The various simulations differ with respect to the degree of correlation between gross income and fines, the degree of taxpayers risk aversion, the probability of detection, the average levels of income and fines. Notice that, in all simulations, $q_{111} > \Pr(h_1 = 1)$. Moreover, $n_{011} < .2$ but in simulation VIII in which it is equal to .364. Therefore, in all cases,

$$\Pr(h_2^* = 1 | \, h_1 = 1 \text{ and notified}) > \Pr(h_2^{**} = 1 | \, h_1 = 0, \text{ notified}),$$

as discussed in Section 3 when commenting the results shown in Proposition 1.

Appendix B: Additional tables of the empirical analysis

Tables from B.1 to B7.

[12] The Excel spreadsheet used to compute the numerical simulation is available from the authors upon request.

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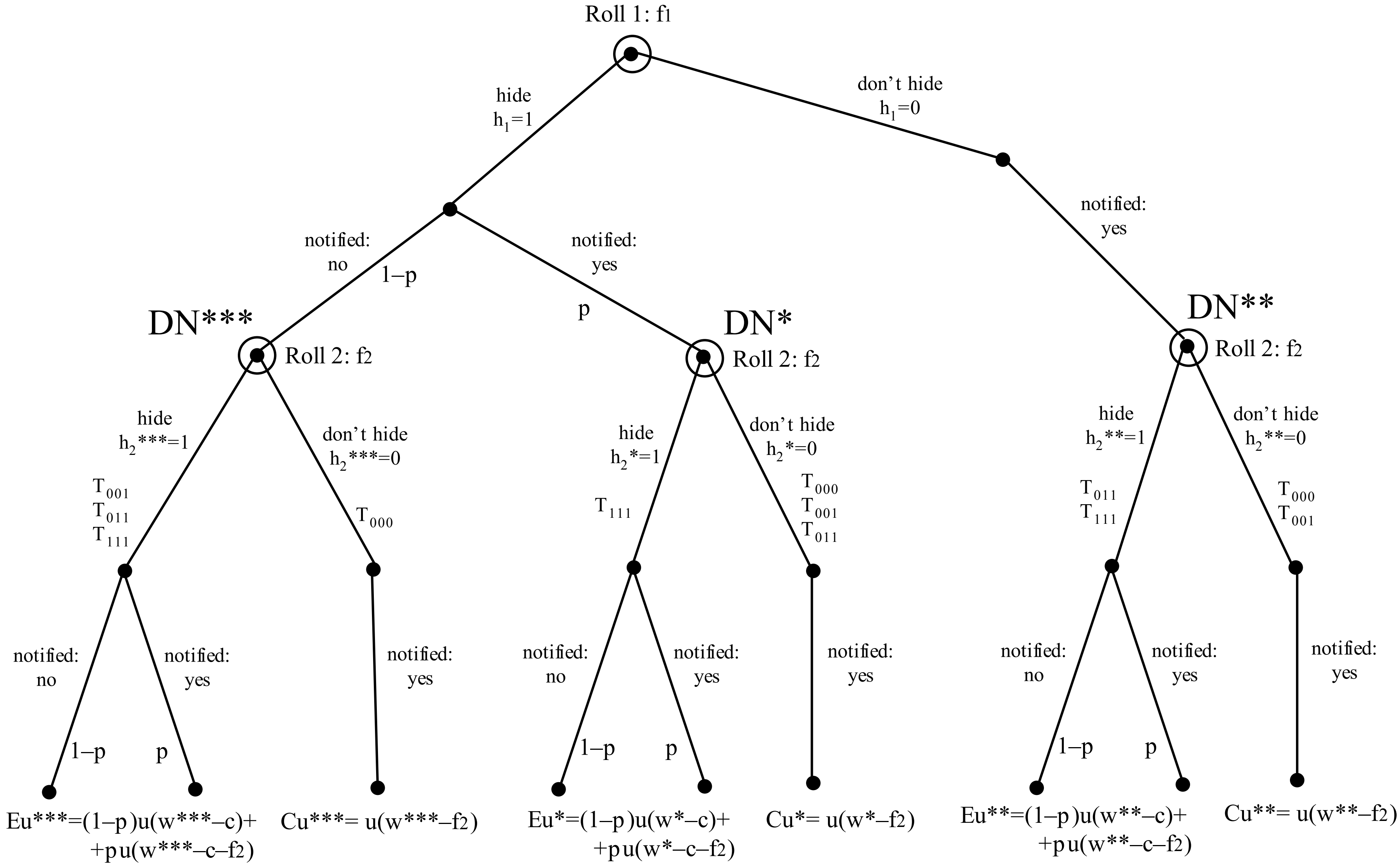

Figure 1: The decision tree of a typical taxpayer

Table 1. Definition of the variables used in the estimated LOGIT models

VARIABLE	*DEFINITION*
Prob_ADCHANGE	*Probability that the individual runs away to escape tax notice*
NOT	*1: the individual has experienced a prior notice*
TAX1	*1: the amount of the tax roll is until 100 €*
TAX2	*1: the amount of the tax roll is between 101 and 2,000 €*
TAX3	*1: the amount of the tax roll is between 2,001 and 50,000 €*
TAX4	*1: the amount of the tax roll is over 50,000 €*
FEM	*1: the individual is a female*
AGE1	*1: the age of the individual is between 18 and 25*
AGE2	*1: the age of the individual is between 26 and 35*
AGE3	*1: the age of the individual is between 36 and 50*
AGE4	*1: the age of the individual is between 51 and 65*
AGE5	*1: the age of the individual is over 65*

Table 2. Summary statistics of the main variables (used in all the estimated LOGIT models)

Province	AOSTA		BELLUNO		MANTOVA		MODENA		PORDENONE		TRENTO		TREVISO		POOLED SAMPLES	
Sample of resident individuals																
	mean	st.dev.	mean	st.dev.	mean	st.dev.	mean	st.dev.	mean	st.dev.	mean	st.dev.	mean	st.dev.	mean	st.dev.
Prob_ADCHANGE	0.603	0.489	0.570	0.495	0.527	0.499	0.512	0.500	0.563	0.496	0.540	0.498	0.554	0.497	0.536	0.499
NOT	0.097	0.296	0.160	0.367	0.115	0.320	0.153	0.360	0.126	0.332	0.135	0.342	0.163	0.370	0.142	0.349
TAX1	0.242	0.428	0.257	0.437	0.219	0.414	0.204	0.403	0.231	0.422	0.230	0.421	0.235	0.424	0.221	0.415
TAX2	0.594	0.491	0.567	0.496	0.602	0.490	0.648	0.478	0.627	0.484	0.610	0.488	0.581	0.493	0.617	0.486
TAX3	0.161	0.367	0.171	0.377	0.176	0.380	0.145	0.352	0.139	0.346	0.157	0.363	0.181	0.385	0.159	0.366
TAX4	0.003	0.054	0.005	0.071	0.003	0.058	0.003	0.051	0.002	0.049	0.004	0.064	0.003	0.055	0.003	0.055
Observations	10,090		4,187		24,078		64,975		13,527		18,575		33,356		168,788	
Sample of non-resident individuals																
	mean	st.dev.	mean	st.dev.	mean	st.dev.	mean	st.dev.	mean	st.dev.	mean	st.dev.	mean	st.dev.	mean	st.dev.
Prob_ADCHANGE	0.375	0.484	0.312	0.464	0.339	0.473	0.388	0.487	0.321	0.467	0.335	0.472	0.349	0.477	0.357	0.479
NOT	0.067	0.250	0.052	0.223	0.069	0.254	0.078	0.268	0.059	0.235	0.055	0.229	0.090	0.286	0.074	0.262
TAX1	0.278	0.448	0.195	0.396	0.208	0.406	0.201	0.400	0.214	0.410	0.224	0.417	0.224	0.417	0.217	0.412
TAX2	0.590	0.492	0.585	0.493	0.631	0.482	0.628	0.483	0.644	0.479	0.600	0.490	0.592	0.491	0.613	0.487
TAX3	0.131	0.338	0.218	0.413	0.159	0.366	0.169	0.375	0.140	0.347	0.173	0.379	0.180	0.384	0.168	0.374
TAX4	0.001	0.023	0.002	0.049	0.001	0.036	0.002	0.042	0.002	0.049	0.002	0.048	0.003	0.058	0.002	0.047
Observations	5,707		2,923		8,675		24,622		6,117		9,270		20,444		77,758	

Table 3. Coefficient and marginal effect estimates for NOT – sample of resident individuals

	POOLED LOGIT model				FE LOGIT model				FE LOGIT model (male only)				FE LOGIT model (female only)			
Province	*Coeff.*	*s.e.*	*Mg. eff.*	*s.e.*	*Coeff.*	*s.e.*	*Mg. eff.*	*s.e.*	*Coeff.*	*s.e.*	*Mg. eff.*	*s.e.*	*Coeff.*	*s.e.*	*Mg. eff.*	*s.e.*
AOSTA	-0.391***	0.068	-0.096***	0.018	-0.421***	0.090	-0.074***	0.026	-0.334***	0.118	-0.060**	0.026	-0.710***	0.216	-0.108*	0.058
BELLUNO	-0.918***	0.089	-0.226***	0.022	-0.782***	0.151	-0.122***	0.045	-0.755***	0.188	-0.106**	0.046	-0.900**	0.353	-0.211	0.156
MANTOVA	-0.441***	0.041	-0.110***	0.010	-0.416***	0.080	-0.103***	0.017	-0.403***	0.085	-0.100***	0.018	-0.484***	0.161	-0.117***	0.043
MODENA	-0.445***	0.022	-0.111***	0.005	-0.438***	0.037	-0.109***	0.008	-0.427***	0.044	-0.106***	0.009	-0.476***	0.068	-0.116***	0.017
PORDENONE	-0.496***	0.053	-0.123***	0.014	-0.364***	0.082	-0.089***	0.021	-0.361***	0.096	-0.088***	0.020	-0.384**	0.182	-0.095**	0.045
TRENTO	-0.442***	0.044	-0.110***	0.012	-0.313***	0.078	-0.072***	0.016	-0.330***	0.081	-0.076***	0.018	-0.247	0.157	-0.051	0.038
TREVISO	-0.681***	0.030	-0.169***	0.007	-0.580***	0.058	-0.137***	0.013	-0.628***	0.064	-0.145***	0.015	-0.365***	0.107	-0.081**	0.039

Table 4. Average predicted probabilities from POOLED LOGIT model – sample of resident individuals

Province	*AOSTA*			*BELLUNO*			*MANTOVA*			*MODENA*			*PORDENONE*			*TRENTO*			*TREVISO*		
NOT	*0*	*1*	Δ	*0*	*1*	Δ	*0*	*1*	Δ	*0*	*1*	Δ	*0*	*1*	Δ	*0*	*1*	Δ	*0*	*1*	Δ
All	0.61	0.52	-10%	0.61	0.38	-23%	0.54	0.43	-11%	0.53	0.42	-11%	0.58	0.46	-12%	0.55	0.45	-11%	0.58	0.41	-17%
TAX1 = 1	0.60	0.50	-10%	0.59	0.36	-23%	0.54	0.44	-10%	0.53	0.42	-11%	0.59	0.47	-12%	0.55	0.43	-12%	0.58	0.41	-17%
TAX2 = 1	0.61	0.52	-9%	0.62	0.39	-23%	0.54	0.44	-10%	0.53	0.43	-10%	0.59	0.46	-13%	0.56	0.45	-11%	0.58	0.42	-16%
TAX3 = 1	0.63	0.54	-9%	0.59	0.37	-22%	0.52	0.41	-11%	0.50	0.39	-11%	0.52	0.41	-11%	0.56	0.45	-11%	0.57	0.40	-17%
TAX4 = 1	0.70	-	-	0.80	0.62	-18%	0.45	0.34	-11%	0.42	0.32	-10%	0.49	0.33	-16%	0.51	0.39	-12%	0.58	0.42	-16%
FEM = 0	0.60	0.51	-10%	0.60	0.37	-23%	0.53	0.43	-11%	0.52	0.41	-11%	0.57	0.45	-12%	0.55	0.44	-11%	0.58	0.41	-17%
FEM = 1	0.64	0.54	-10%	0.65	0.42	-23%	0.57	0.46	-11%	0.57	0.46	-11%	0.61	0.49	-12%	0.58	0.47	-11%	0.61	0.44	-17%
AGE1 = 1	0.54	0.46	-8%	0.50	0.29	-21%	0.51	0.40	-11%	0.47	0.36	-10%	0.49	0.37	-12%	0.50	0.40	-10%	0.55	0.38	-17%
AGE2 = 1	0.59	0.50	-10%	0.59	0.37	-22%	0.53	0.42	-11%	0.51	0.40	-11%	0.55	0.43	-12%	0.54	0.43	-11%	0.57	0.40	-17%
AGE3 = 1	0.61	0.52	-9%	0.60	0.38	-22%	0.53	0.42	-11%	0.52	0.42	-11%	0.58	0.45	-12%	0.55	0.44	-11%	0.57	0.40	-17%
AGE4 = 1	0.61	0.52	-10%	0.64	0.41	-23%	0.57	0.46	-11%	0.56	0.45	-11%	0.60	0.48	-12%	0.58	0.47	-11%	0.60	0.43	-17%
AGE5 = 1	0.68	0.58	-10%	0.70	0.51	-20%	0.64	0.54	-10%	0.63	0.52	-11%	0.68	0.57	-11%	0.66	0.55	-11%	0.68	0.52	-16%

Table A.1: Numerical simulations of the theoretical model

	I	II	III	IV	V	VI	VII	VIII
w_min	15,00	15,00	15,00	15,00	15,00	15,00	15,00	15,00
w_max	25,00	25,00	25,00	25,00	25,00	30,00	25,00	25,00
f1_min	2,00	1,00	2,00	2,00	1,00	1,00	1,00	5,00
f1_max	5,00	6,00	5,00	7,00	7,00	11,00	8,00	8,00
f2_min	2,00	1,00	2,00	2,00	1,00	1,00	1,00	5,00
f2_max	5,00	6,00	5,00	7,00	7,00	11,00	8,00	8,00
a1	0,20	0,20	0,10	0,20	0,25	0,40	0,30	0,50
a2	0,20	0,20	0,10	0,20	0,25	0,40	0,30	0,50
c(w,f1)	0,89	0,55	0,45	0,55	0,58	0,83	0,60	0,93
c(w,f2)	0,89	0,55	0,45	0,55	0,58	0,83	0,60	0,93
c	2,00	2,00	2,00	2,00	2,00	2,00	2,00	2,00
rho	2,00	2,00	2,00	1,00	1,00	4,00	0,50	2,00
p	0,40	0,40	0,40	0,40	0,50	0,30	0,50	0,40
n000	59,00	59,00	62,00	22,00	59,00	16,80	43,00	8,00
n001	2,70	2,10	4,00	1,30	2,80	8,40	0,50	8,50
n011	4,10	4,50	5,70	3,00	3,20	16,50	1,80	36,40
n111	34,20	34,40	28,30	73,70	35,00	58,10	54,70	47,10
q000	10,34	30,17	26,94	60,91	29,49	35,71	45,81	30,00
q001	48,15	80,95	35,00	76,92	67,86	41,67	100,00	57,65
q011	46,34	31,11	36,84	83,33	28,13	63,03	66,67	79,67
q111	84,21	52,91	47,70	80,87	52,00	91,05	63,80	95,97
Pr(h1=1)	38,10	39,10	33,70	76,50	38,40	72,80	56,30	81,50
Pr* **	83,99	54,48	50,45	82,48	54,69	91,76	65,01	97,06
Pr*	75,59	46,55	40,06	77,91	47,40	72,66	61,99	55,46
Pr**	12,28	31,69	27,75	62,13	31,01	42,28	46,68	50,27

c(w,f1) = correlation between w and f1
c(w,f2) = correlation between w and f1
c = cost of hiding
rho = coefficient of relative risk aversion
p = probability of detection

Table B.1. Summary statistics of the control variables (used in the estimated POOLED LOGIT model)

Province	*AOSTA*		*BELLUNO*		*MANTOVA*		*MODENA*		*PORDENONE*		*TRENTO*		*TREVISO*		*POOLED SAMPLES*	
Sample of resident individuals																
	mean	*st.dev.*	*mean*	*st.dev.*	*mean*	*st.dev.*	*mean*	*st.dev.*	*mean*	*st.dev.*	*mean*	*st.dev.*	*mean*	*st.dev.*	*mean*	*st.dev.*
FEM	0.225	0.418	0.157	0.364	0.164	0.370	0.206	0.404	0.196	0.397	0.180	0.384	0.186	0.389	0.192	0.394
AGE1	0.019	0.137	0.031	0.172	0.021	0.142	0.021	0.143	0.017	0.129	0.025	0.157	0.020	0.140	0.021	0.143
AGE2	0.198	0.398	0.228	0.419	0.264	0.441	0.244	0.430	0.219	0.413	0.241	0.428	0.235	0.424	0.240	0.427
AGE3	0.483	0.500	0.467	0.499	0.497	0.500	0.512	0.500	0.505	0.500	0.487	0.500	0.498	0.500	0.501	0.500
AGE4	0.256	0.436	0.235	0.424	0.180	0.385	0.188	0.390	0.222	0.416	0.213	0.409	0.208	0.406	0.201	0.401
AGE5	0.045	0.207	0.039	0.194	0.038	0.191	0.035	0.185	0.038	0.191	0.034	0.181	0.039	0.194	0.037	0.189
Observations	10,090		4,187		24,078		64,975		13,527		18,575		33,356		168,788	
Sample of non-resident individuals																
	mean	*st.dev.*	*mean*	*st.dev.*	*mean*	*st.dev.*	*mean*	*st.dev.*	*mean*	*st.dev.*	*mean*	*st.dev.*	*mean*	*st.dev.*	*mean*	*st.dev.*
FEM	0.235	0.424	0.175	0.380	0.162	0.368	0.194	0.396	0.179	0.383	0.170	0.375	0.176	0.381	0.184	0.387
AGE1	0.013	0.115	0.023	0.149	0.017	0.129	0.019	0.136	0.013	0.111	0.023	0.149	0.024	0.152	0.020	0.139
AGE2	0.187	0.390	0.205	0.404	0.233	0.423	0.241	0.428	0.199	0.399	0.235	0.424	0.232	0.422	0.228	0.420
AGE3	0.475	0.499	0.472	0.499	0.463	0.499	0.470	0.499	0.469	0.499	0.465	0.499	0.466	0.499	0.468	0.499
AGE4	0.271	0.444	0.267	0.443	0.232	0.422	0.224	0.417	0.269	0.443	0.235	0.424	0.235	0.424	0.238	0.426
AGE5	0.054	0.227	0.033	0.178	0.055	0.228	0.045	0.208	0.051	0.220	0.043	0.202	0.043	0.203	0.046	0.210
Observations	5,707		2,923		8,675		24,622		6,117		9,270		20,444		77,758	

Table B.2. Coefficient estimates from POOLED LOGIT model – sample of resident individuals

Province	*AOSTA*			*BELLUNO*			*MANTOVA*			*MODENA*			*PORDENONE*			*TRENTO*			*TREVISO*		
Regressors[a]	*Coeff.*	*s.e.*		*Coeff.*	*s.e.*		*Coeff.*	*s.e.*		*Coeff.*	*s.e.*		*Coeff.*	*s.e.*		*Coeff.*	*s.e.*		*Coeff.*	*s.e.*	
NOT	-0.391	0.068	***	-0.918	0.089	***	-0.441	0.041	***	-0.445	0.022	***	-0.496	0.053	***	-0.442	0.044	***	-0.681	0.030	***
TAX1	-0.459	0.409		-1.004	0.462	**	0.450	0.226	**	0.443	0.160	***	0.417	0.351		0.179	0.235		0.014	0.209	
TAX2	-0.364	0.408		-0.836	0.459	*	0.461	0.225	**	0.461	0.159	***	0.388	0.350		0.244	0.234		0.046	0.209	
TAX3	-0.301	0.410		-0.957	0.463	**	0.361	0.226		0.316	0.160	**	0.140	0.352		0.248	0.236		-0.025	0.208	
FEM	0.158	0.050	***	0.202	0.090	**	0.087	0.036	**	0.178	0.020	***	0.145	0.045	***	0.106	0.039	***	0.089	0.029	***
AGE2	0.180	0.152		0.382	0.197	*	0.048	0.093		0.165	0.057	***	0.230	0.138	*	0.149	0.098		0.078	0.081	
AGE3	0.266	0.148	*	0.391	0.192	**	0.068	0.092		0.226	0.056	***	0.328	0.135	**	0.167	0.095	*	0.070	0.080	
AGE4	0.265	0.151	*	0.493	0.198	**	0.167	0.096	*	0.344	0.058	***	0.421	0.138	***	0.280	0.099	***	0.183	0.082	**
AGE5	0.583	0.178	***	0.788	0.252	***	0.439	0.114	***	0.585	0.070	***	0.748	0.163	***	0.618	0.125	***	0.517	0.098	***
Constant	0.637	0.456		1.015	0.496	**	-0.365	0.251		0.126	0.630		-0.239	0.437		-0.587	0.430		0.235	0.247	
Observations	10,090			4,187			24,078			64,975			13,527			18,575			33,356		
Wald test [p-value]	102 [0.000]			161 [0.000]			265 [0.000]			806 [0.000]			201 [0.000]			213 [0.000]			688 [0.000]		

*[a] Dependent variable: Prob_ADCHANGE. Reference individual: NOT = 0, TAX4 = 1, FEM = 0, AGE1 = 1; dummies for birth place included (4 Italian and 9 world geographical zones). Significance level: *** 1%, ** 5%, *10%; s.e. are robust standard errors.*

Table B.3. Coefficient estimates from FE LOGIT model – sample of resident individuals

Province	*AOSTA*			*BELLUNO*			*MANTOVA*			*MODENA*			*PORDENONE*			*TRENTO*			*TREVISO*		
Regressors[a]	*Coeff.*	*s.e.*		*Coeff.*	*s.e.*		*Coeff.*	*s.e.*		*Coeff.*	*s.e.*		*Coeff.*	*s.e.*		*Coeff.*	*s.e.*		*Coeff.*	*s.e.*	
NOT	-0.421	0.090	***	-0.782	0.151	***	-0.416	0.080	***	-0.438	0.037	***	-0.364	0.082	***	-0.313	0.078	***	-0.580	0.058	***
TAX1	-1.228	0.474	***	-1.127	0.640	*	0.353	0.299		0.032	0.180		-0.207	0.474		-0.604	0.256	**	-0.259	0.369	
TAX2	-0.996	0.471	**	-1.001	0.606	*	0.380	0.296		0.144	0.184		-0.143	0.471		-0.409	0.264		-0.120	0.369	
TAX3	-0.868	0.463	*	-1.073	0.634	*	0.372	0.302		0.182	0.187		-0.156	0.481		-0.323	0.271		-0.153	0.364	
Observations	6,317			2,415			15,494			46,268			8,489			12,162			21,022		
Wald test [p-value]	34 [0.000]			29 [0.000]			28 [0.000]			184 [0.000]			20 [0.000]			40 [0.000]			119 [0.000]		

*[a] Dependent variable: Prob_ADCHANGE. Reference individual: NOT = 0, TAX4 = 1; individual fixed effects included. Significance level: *** 1%, ** 5%, *10%; s.e. are robust standard errors.*

Table B.4. Coefficient estimates from FE LOGIT model – sample of resident individuals (male only)

Province	*AOSTA*			*BELLUNO*			*MANTOVA*			*MODENA*			*PORDENONE*			*TRENTO*			*TREVISO*		
Regressors[a]	*Coeff.*	*s.e.*		*Coeff.*	*s.e.*		*Coeff.*	*s.e.*		*Coeff.*	*s.e.*		*Coeff.*	*s.e.*		*Coeff.*	*s.e.*		*Coeff.*	*s.e.*	
NOT	-0.334	0.118	***	-0.755	0.188	***	-0.403	0.085	***	-0.427	0.044	***	-0.361	0.096	***	-0.330	0.081	***	-0.628	0.064	***
TAX1	-1.215	0.685	*	-1.355	0.613	**	0.312	0.352		0.081	0.217		-0.089	0.469		-0.558	0.314	*	-0.350	0.306	
TAX2	-0.989	0.680		-1.172	0.611	*	0.353	0.354		0.178	0.208		-0.025	0.468		-0.389	0.306		-0.205	0.297	
TAX3	-0.882	0.668		-1.239	0.627	**	0.316	0.354		0.220	0.205		-0.028	0.480		-0.299	0.310		-0.219	0.291	
Observations	5,098			2,114			13,368			37,892			7,021			10,242			17,591		
Wald test [p-value]	24 [0.000]			21 [0.000]			35 [0.000]			121 [0.000]			16 [0.001]			39 [0.000]			108 [0.000]		

*[a] Dependent variable: Prob_ADCHANGE. Reference individual: NOT = 0, TAX4 = 1; individual fixed effects included. Significance level: *** 1%, ** 5%, *10%; s.e. are robust standard errors.*

Table B.5. Coefficient estimates from FE LOGIT model – sample of resident individuals (female only)

Province	*AOSTA*			*BELLUNO*			*MANTOVA*			*MODENA*			*PORDENONE*			*TRENTO*			*TREVISO*		
Regressors[a]	*Coeff.*	*s.e.*		*Coeff.*	*s.e.*		*Coeff.*	*s.e.*		*Coeff.*	*s.e.*		*Coeff.*	*s.e.*		*Coeff.*	*s.e.*		*Coeff.*	*s.e.*	
NOT	-0.710	0.216	***	-0.900	0.353	**	-0.484	0.161	***	-0.476	0.068	***	-0.384	0.182	***	-0.247	0.157		-0.365	0.107	***
TAX1	-1.361	1.277		0.196	0.301		0.601	0.837		-0.171	0.437		0.015	0.210		-1.023	1.041		0.828	1.114	
TAX2	-1.091	1.270		-0.146	0.363		0.536	0.830		0.009	0.435		0.077	0.185		-0.698	1.035		0.923	1.112	
TAX3	-0.828	1.265		-0.125	0.921		0.733	0.833		0.029	0.436		0.124	0.453		-0.627	1.033		0.765	1.110	
Observations	1,219			301			2,126			8,376			1,468			1,920			3,431		
Wald test [p-value]	14 [0.007]			8 [0.095]			11 [0.029]			42 [0.000]			8 [0.088]			10 [0.050]			13 [0.011]		

*[a] Dependent variable: Prob_ADCHANGE. Reference individual: NOT = 0, TAX4 = 1; individual fixed effects included. Significance level: *** 1%, ** 5%, *10%; s.e. are robust standard errors.*

Table B.6. Coefficient estimates from POOLED LOGIT model – sample of non-resident individuals

Province	AOSTA		BELLUNO		MANTOVA		MODENA		PORDENONE		TRENTO		TREVISO	
Regressors[a]	Coeff.	s.e.	Coeff.	s.e.	Coeff.	s.e.	Coeff.	s.e.	Coeff.	s.e.	Coeff.	s.e.	Coeff.	s.e.
NOT	-0.004	0.111	0.135	0.182	-0.489	0.401	-0.100	0.150	-0.229	0.125	0.118	0.099	-0.040	0.053
TAX1	0.194	1.271	1.022	1.168	-0.101	0.722	-0.135	0.306	-0.213	0.489	-0.168	0.486	-0.360	0.251
TAX2	0.346	1.270	1.148	1.166	-0.188	0.721	-0.245	0.305	-0.208	0.487	0.001	0.484	-0.342	0.250
TAX3	0.295	1.272	1.149	1.168	-0.148	0.722	-0.381	0.306	-0.139	0.491	0.056	0.486	-0.408	0.252
FEM	-0.178	0.067 ***	0.059	0.109	0.097	0.064	0.047	0.034	-0.090	0.075	-0.001	0.061	0.005	0.040
AGE2	0.151	0.248	-0.107	0.271	-0.181	0.175	-0.082	0.098	-0.162	0.233	0.270	0.158 *	0.303	0.103 ***
AGE3	0.029	0.243	-0.043	0.263	-0.310	0.173 *	-0.133	0.096	-0.389	0.229 *	0.211	0.155	0.245	0.101 **
AGE4	-0.270	0.246	-0.305	0.273	-0.456	0.178 **	-0.240	0.098 **	-0.737	0.233 ***	-0.114	0.160	0.125	0.104
AGE5	-0.232	0.270	-0.329	0.354	-0.681	0.204 ***	-0.255	0.113 **	-1.046	0.268 ***	-0.274	0.192	0.022	0.125
Constant	-0.860	1.292	-1.650	1.202	-0.517	0.742	0.033	0.325	0.192	0.545	-0.590	0.514	-0.485	0.271 *
Observations	5,707		2,923		8,675		24,622		6,117		9,270		20,444	
Wald test [p-value]	103 [0.000]		105 [0.000]		343 [0.000]		322 [0.000]		243 [0.000]		320 [0.000]		460 [0.000]	

[a] Dependent variable: Prob_ADCHANGE. Reference individual: NOT = 0, TAX4 = 1, FEM = 0, AGE1 = 1; dummies for birth place included (4 Italian and 9 world geographical zones). Significance level: *** 1%, ** 5%, *10%; s.e. are robust standard errors.

Table B.7. Coefficient estimates from FE LOGIT model – sample of non-resident individuals

Province	AOSTA		BELLUNO		MANTOVA		MODENA		PORDENONE		TRENTO		TREVISO	
Regressors[a]	Coeff.	s.e.	Coeff.	s.e.	Coeff.	s.e.	Coeff.	s.e.	Coeff.	s.e.	Coeff.	s.e.	Coeff.	s.e.
NOT	-0.432	0.384	-0.192	0.318	-1.218	1.201	-0.545	0.687	-0.914	0.829	-0.534	0.583	-0.288	0.388
TAX1	0.050	0.113	-0.447	1.506	-0.642	1.231	-0.285	0.476	-0.022	0.736	-0.524	0.747	-0.576	0.356
TAX2	-0.170	0.159	0.027	1.494	-0.703	1.227	-0.239	0.473	-0.094	0.729	-0.386	0.746	-0.504	0.352
TAX3	-0.120	0.420	-1.073	0.600	-0.688	1.225	-0.369	0.475	-0.174	0.734	-0.391	0.748	-0.570	0.353
Observations	2,393		920		2,944		10,778		1,992		3,009		8,579	
Wald test [p-value]	5 [0.249]		6 [0.197]		7 [0.121]		6 [0.204]		3 [0.535]		5 [0.316]		6 [0.178]	

[a] Dependent variable: Prob_ADCHANGE. Reference individual: NOT = 0, TAX4 = 1; individual fixed effects included. Significance level: *** 1%, ** 5%, *10%; s.e. are robust standard errors.