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June 2023

Online at https://mpra.ub.uni-muenchen.de/117825/
MPRA Paper No. 117825, posted 05 Jul 2023 14:03 UTC

On the need to anticipate behavioral responses to policies: the case of multiple refilings on taxpayer behavior in Ecuador

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Abstract

In this paper we document the use of multiple refilings to evade taxes using administrative data from Ecuador. Then, we develop a model to study the role of multiple refilings on the behavior of taxpayers that received tax notifications because they under-reported taxes. Our model finds that if multiple refilings are possible, then the better decision for selfish taxpayers is to evade taxes. Differently, the model finds that if multiple refilings are not possible, then for taxpayers who exhibit strong social preferences their better decision is to comply even if the probability of being notified is relatively low. The model also shows that banning the possibility of multiple refilings is a necessary but not sufficient condition to achieve true reporting. Nevertheless, the results imply that for both selfish and socially minded taxpayers, limiting the use of multiple refilings reduces their expected payoff of tax evasion and, therefore, increases the probability of tax compliance.

Keywords: Tax compliance, refiling, tax evasion, Ecuador; policies future effects.

JEL classification: C72, H25, H26, K42.

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1 Introduction

There is a rich literature that studies the effects of diverse interventions to reduce tax evasion. These interventions are usually complex and involve behavioral or punitive strategies, or a combination of them. In this paper we study a rather simple alternative that has not been studied in detail in the literature: reducing the capacity of taxpayers to refile their taxes. We examine this issue in the specific context of the tax control policies applied in Ecuador in 2010 and subsequent years. Our findings, however, may apply more widely. Building upon Sánchez (2022), our paper documents that, after receiving a tax notification, taxpayers in Ecuador used refiling to evade taxes. Specifically, the paper finds that, although tax notifications sent to taxpayers who have under-reported the income tax advance (ITA) in Ecuador increased reported taxes they, however, did not affect collected taxes. It also presents evidence that some taxpayers initially refiled to correct their miscalculations but later they refiled again to evade taxes. The evidence is stronger when evading the ITA implies reducing the tax liability.

Within this context, we develop a model to study the role of multiple refilings on the behavior of taxpayers. Our model finds that, if multiple refilings are possible and taxpayers are exclusively selfish (i.e. only care about their individual payoffs), then their better decision (in the sense it maximizes expected payoffs) is to under-report their ITA even if tax authorities never miss their under-reporting. Therefore, policymakers who intend to enact some new policy to reduce tax evasion should consider carefully whether it will indeed give selfish tax payers incentive to comply. In fact, the work of Allingham & Sandmo (1972), the classic theoretical contribution on the individual taxpayer's decision to avoid taxes by deliberately under-reporting income, begins its analysis stating that "the tax declaration is a decision under uncertainty" (p. 324). But such a statement actually implies that under-reporters face some probability of being caught and, if so, actually end up worse. However, we find that the tax control policy applied by tax authorities in Ecuador in 2010, and which was the case until 2013, did not create such uncertainty for selfish taxpayers but for them under-reporting remained their optimal decision even if tax authorities caught them. So, the first finding of this paper implies a call for policymakers to carefully think, in advance of applying some policy, if it would actually change (at least to some extent) the incentives of selfish economic agents.[1]

In order to explore possible solutions to the problem of tax evasion, we then extend our model. We do this in two steps. First, remaining in the context of selfish taxpayers,

[1]Simply, our model assumes that taxpayers choose the strategy which maximizes expected payoff. By definition, the latter is

$$\pi^s = \sum_{i=1}^{N} a_i A_i$$

in which s denotes the strategy we are referring to (in our context, there are only two such strategies: reporting the true tax and under-reporting it), a_i the probability that outcome i occurs (in our context, there are only two outcomes for each strategy: receive a notification from part of tax authorities and not receiving it), A_1 the payoff received if outcome i happens, and N the number of possible outcomes (in our context, $N = 2$). In turn, by definition the (so-called) expected utility for taxpayers of choosing strategy s is given by

$$U^s = \sum_{i=1}^{N} a_i U_i$$

in which U_i denotes the utility the taxpayer obtains when outcome i happens. Then, it could be seen that, if the utility that every outcome yields is the same as its payoff (that is, $U_i = A_i$ for every i), then $\pi^s = U^s$; and, thus, maximizing expected payoffs is the same as maximizing expected utility. Now, if it is also the case that every payoff A_i is linear, then the assumption that taxpayers maximize expected payoffs also implies assuming that they are risk-neutral (because then every $U_i = A_i$ is a linear function). And, in fact, in our analyses every A_i is linear. Thus, our models actually assume that taxpayers are risk-neutral. But it's important to note that, as long as the degree of risk-aversion that taxpayers exhibit when they report their true income is the same as when they under-report it, then the finding that under-reporting is the expected utility maximizing decision for selfish taxpayers when multiple refiling is possible (even if tax authorities never miss their under-reporting) is not altered. (See Footnote 9).

we examine the effects of banning multiple refilings; which should be highlighted was what Ecuadorian tax authorities did since 2013. The model then finds that banning multiple refilings is a necessary but not a sufficient condition to achieve that selfish taxpayers report the truth. Furthermore, we find that having a proficient tax authority which often catches under-reporters is key to successfully curb tax evasion in this scenario. Second, we examine the effects of having taxpayers who to some degree exhibit social preferences (i.e. to some extent care about the effects of paying taxes for society in large) on tax compliance, both in the case in which multiple refilings are allowed and in the case in which they are banned.[2] Then, in the former scenario, the model finds that social preferences help to reduce tax evasion but (unless they are unrealistically strong) don't omit the need for tax authorities to proficiently catch under-reporting. In the latter scenario, the model finds that taxpayers will truthfully report even if the probability of being caught if they under-report is relatively low.

The conclusions we derive from the analysis are, therefore, straightforward. First and foremost, we conclude that a policy which limits the use of multiple refilings is desirable. This is the case because it significantly reduces the expected payoff from under-reporting and, therefore, increases tax compliance for both selfish and socially minded taxpayers. Second,

[2]The textbook definition of social preferences (often also called other-regarding preferences) are those that place a value on what happens to other people even if it results in lower payoffs for the individual (The CORE Team, 2017). Thus, they include both caring for others because of, say, nice motives (like being altruistic), and caring for others because of say, not nice motives (like exhibiting envy or spite). For brevity, in this paper we use the term only in the nice way. Reviews of the large literature on social preferences are presented in Sobel (2005), Fehr & Schmidt (2006), and List (2009).

we conclude that the proliferation of social preferences is desirable. However, let us be clear, examining the specific policies to foster such proliferation is beyond the scope of this paper.[3]

Broadly, the literature on the enforcement of tax compliance can be classified as the studies of punitive and behavioral strategies. An example of the former is the evaluation of the impact of audit rates and rules on compliance (for instance Dubin et al., 1990; Alm et al., 1993; Mittone, 2006; Dubin, 2007; Kleven et al., 2011). The latter literature's branch is relatively recent and it has focused on the study of nudges. For instance, Moulton et al. (2022), use a field experiment to find that reminders about payment obligations cause a reduction in the probability of missing payments of property tax among older adults who took out a reverse mortgage. Other studies about the effect of nudges on tax compliance include Blumenthal et al. (2001); Hallsworth et al. (2017); Meiselman (2018); John (2018), and Fišar et al. (2021).

This paper contributes to the literature in several ways. First, it is, to the best of our knowledge, the first study that empirically and theoretically analyzes the role of multiple refilings on tax compliance. Second, we show that, unless a person's care for the welfare of society as a whole is unrealistically strong, the better decision for taxpayers is to evade taxes if they are allowed to refile multiple times. Third, we contribute to the small but growing literature that studies the strategies that taxpayers use in complex tax systems in which taxes are interrelated (for instance Carrillo et al., 2017; Yang, 2008). Finally, we present a simple policy recommendation to prevent tax evasion that consists of limiting multiple

[3]The same as in most Economics' papers, in this one we assume that agents' preferences are exogenous to policies. However, there are several contributions in which, in a variety of contexts, policies actually affect preferences (for instance Norton et al., 1998; Gómez-Ramírez, 2014). Bowles (1998) presents a larger discussion on the ways in which preferences could be endogenous to markets and other economics institutions.

refilings. Importantly, this policy was already taken by the Ecuadorian tax authority in 2013.

The rest of the paper is organized as follows. Section 2 presents the institutional background around the ITA in Ecuador and the associated empirical findings which motivate our theoretical inquiry. Section 3 presents the formal analysis when multiple refilings are allowed. Section 4 presents, first, the formal analysis when multiple refilings are blocked; and, second, the formal analysis in the presence of taxpayers with social preferences. Section 5 concludes.

2 The income tax advance

We describe the Ecuadorian tax legislation valid for the fiscal year 2010 and that is relevant for this research. The income tax (IT) in Ecuador is similar the one in the USA. For individuals it is determined using a progressive tax schedule with marginal rates that go from 5 to 35%. For corporations the IT is calculated as a flat rate of the tax base that was 25% in 2010.

In addition to the IT, Ecuadorian taxpayers have to file the income tax advance (ITA). When taxpayers file their IT_{t-1} (in March or April of year t), they also determine the ITA_t. We study corporations and individuals who are required to keep accounting records. For them the ITA_t is calculated as a function of tax records corresponding to the year $t-1$. Specifically, it is equal to sum of 0.4% of the total assets, 0.4% of the total taxable income, 0.2% of the net worth, and 0.2% of deductible expenses.

It is important to note that the ITA is a minimum income tax. When taxpayers file their IT_t (in the year $t+1$), the IT_t and the ITA_t are compared, and the greater of the two becomes the relevant income tax (RIT_t). Moreover, there is an anticipated portion of the ITA_t that is paid in two equal parts in July and September of year t (before the IT_t is determined). This amount is equal to the ITA_t minus taxes withheld (by third parties) in year $t-1$.

Clearly, there are incentives to evade the ITA. First, a lower ITA_t means a lower anticipated payment and hence more liquidity for the taxpayer in year t. More importantly, a lower ITA_t could potentially imply less paid taxes if the ITA_t ends up being greater than the IT_t. Sánchez (2022) shows evidence that these incentives are strong, because it documents that in the fiscal year 2010 around 7% of total number of corporations and individually-owned businesses obligated to keep accounting records under-reported the ITA. More details about the ITA in Ecuador are presented in that paper.

2.1 Tax enforcement

As a response to the under-reporting of the ITA, the Ecuadorian tax authority implemented a program to control evasion which included delivering tax notifications. In 2010 these notifications were delivered by tax officials, instead of the postal service.[4] However, because of human resources constraints, not all the taxpayers who, in 2010, under-reported the ITA received a notification. Only those with the greatest under-reported amounts were selected

[4] Currently, most tax notifications are delivered electronically, but in 2010 the tax notifications corresponding to the ITA were physically handed by tax officials.

to receive it. That is, due to these restrictions a selection threshold was defined. However, the selection process was not perfect in the sense that some taxpayers not selected to receive the notification were notified and some originally selected were not notified. Note, however, that all the notified taxpayers did evade taxes.

Sánchez (2022) estimates the causal effect of those tax notifications using a fuzzy regression discontinuity design (FRDD) that exploits the exogenous and discrete change in the probability of receiving the notification. Given the nature of the FRDD estimand, the results are interpreted as the effect of the marginal notification on the expected value of the dependent variable. The results indicate that the notification increased the reported ITA in around $900. However, there is no evidence of an effect on the RIT. In other words, the notification increases reported taxes but does not affect taxes collected.

These seemingly contradictory results are explained by strategic behavior. When the ITA is greater than the IT, and therefore the ITA is the RIT, the notification has no effect on the ITA. In contrast, when the ITA is not the RIT because the IT is greater than the ITA, the notification has a positive and significant effect of around $1,000. These results are summarized in Table 1.

Sánchez (2022) argues that the previous results are explained, at least partially, by the fact that multiple refilings were possible, because it allowed the following behavior. When taxpayers were notified, they could refile initially to correct the values and, just for doing so, leave the list of evaders. However, they later could refile again and change the reported ITA in order to evade taxes. To back up this hypothesis, Sánchez (2022) shows evidence

Table 1: RDD estimates of the causal effect of the tax notification (LATE) in US$

Variables	(1) Reported ITA	(2) Collected taxes (RIT)	(3) Reported ITA ITA is RIT	(4) Reported ITA IT is RIT
Conventional	922.2***	-181.3	116.9	981.2***
	(299.9)	(677.5)	(540.3)	(304.0)
Bias-corrected	945.7***	-274.9	94.94	967.6***
	(299.9)	(677.5)	(540.3)	(304.0)
Robust	945.7***	-274.9	94.94	967.6***
	(343.1)	(769.5)	(616.1)	(363.4)
Effective number of observations	6451	6666	1978	5714
Bandwidth	0.983	1.035	1.001	1.045

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.
Adapted from Sánchez (2022). All estimations use triangular kernels and linear polynomials. The results are robust to the use of different kernels and polynomials.
The conventional estimates correspond to a non-parametric estimation that selects the bandwidth that minimize the mean squared error. The bias corrected estimates take into consideration the bias produced by the conventionally chosen bandwidth. The robust estimates adjust the standard errors to take into account the additional variability produce by the bias correction. See Calonico et al. (2014) for details.

that the notification causes a significant increase in the probability of refiling more than one time. Furthermore, the effect of the notification on this probability is significantly stronger when the ITA is the RIT, and therefore there are more incentives to under-report it. These results are summarized in Table 2. Detailed results of the effect of the tax notifications and the identification tests of the FRDD can be seen in that paper.

3 Understanding the issue

Consider the situation, which was the case in Ecuador during 2010-2012, in which (i) if the taxpayer under-reports her/his ITA, then she/he does not necessarily get a notification; with $p \in [0, 1]$ being the probability that tax authorities send her[5] such notification and $1 - p$ the probability they don't; and (ii) she is able to freely refile more than once. The ability to refile

[5]Moving forward, we'll only use feminine terms but, of course, we are referring to all genders.

Table 2: RDD estimates of the causal effect of the tax notification (LATE) on the probability to refile more than once

Variables	(1) Refiling	(2) Refiling ITA is RIT	(3) Refiling IT is RIT
Conventional	0.128***	0.157***	0.117***
	(0.0258)	(0.0323)	(0.0292)
Bias-corrected	0.119***	0.145***	0.102***
	(0.0258)	(0.0323)	(0.0292)
Robust	0.119***	0.145***	0.102***
	(0.0304)	(0.0387)	(0.0350)
Kernel Type	Triangular	Triangular	Triangular
Effective number of observations	6739	3789	6040
Bandwidth	0.900	0.931	1.314

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.
Adapted from Sánchez (2022). All estimations use triangular kernels and linear polynomials. The results are robust to the use of different kernels and polynomials.
The conventional estimates correspond to a non-parametric estimation that selects the bandwidth that minimize the mean squared error. The bias corrected estimates take into consideration the bias produced by the conventionally chosen bandwidth. The robust estimates adjust the standard errors to take into account the additional variability produce by the bias correction. See Calonico et al. (2014) for details.

allows the following two-step (or more) behavior: in a first refiling she could report the true ITA and, just for that, leave the list of evaders, and in a second refiling she could under-report again without any further problem. As we'll shortly see, in this scenario, to under-report their ITA (assuming it is greater than their IT) is the expected payoff maximizing decision for exclusively selfish taxpayers even if tax authorities always send them a notification. By selfish taxpayers, we mean those who only care about their individual and monetary payoffs (do not care about the consequences of evading taxes for society as a whole). But, before proceeding, it's important to point out three things. First, we examine only the case in which the ITA is greater than the IT, because in this scenario taxpayers have greater incentives to under-report the ITA.[6] However, under reasonable assumptions, the result that under-reporting is their payoff maximizing decision also holds when the ITA is smaller than the IT (see Footnote 8). Second, to carry out a general analysis, we posit that, when the taxpayer truthfully reports, she still faces a probability $q \in [0, 1]$ that tax authorities wrongly send her a notification (and a probability $1 - q$ they don't). However, this did not happen in the Ecuador's tax control program for the ITA in the period 2010-2012 in which our analysis is based on. In it, the tax authority only notified non-compliers, that is, $q = 0$ was the case. Consequently, in our analyses we'll highlight the case in which $q = 0$. Third, our models implicitly assume that taxpayers are risk-neutral (see Footnote 1). However, if we assumed they are risk-averse, it turns out that, as long as the degree of risk-aversion they exhibited when they truthfully report is the same as when they under-report, then the finding that under-reporting is the better decision for selfish taxpayers if multiple refiling is possible (even if tax authorities never miss their under-reporting) does not change (see Footnote 9).

Given the institutional framework in which (i) and (ii) above explained are the case, then Table 3 presents the payoffs of the selfish taxpayer for the four possible situations she could face, which are the following: she reports her true ITA and the tax authority sends her a notification, she reports her true ITA and the tax authority does not send her a notification, she under-reports her true ITA and the tax authority sends her a notification, and she under-reports her true ITA and the tax authority does not send her a notification. In the first situation, she will have to pay her true ITA, which we denote by $0 < T$, plus the

[6] In the framework in which taxpayers are selfish and multiple refilings are possible, the expected payoff for under-reporting if the ITA is smaller than the IT (given in Footnote 8) is greater than the expected payoff for under-reporting when if the ITA is greater than the IT (given by Equation 2).

refiling costs of addressing the notification, which we denote by $0 < c$. So, her payoff would be $-(T + c)$. In the second situation, she will only have to pay her true ITA, having then a payoff of $-T$. In the third situation, her payoff would be $-(T + 2c - u(1 + r))$ because of the following. To begin with, she reported $T - u$, in which $0 < u$ is the amount she under-reported; with the only restriction (coming from the fact she can't report a negative ITA) that $u < T$. Furthermore, we assume that, if invested somewhere else, u yields a return of ur, in which $0 < r$ is the rate of return. So, if instead of paying u as taxes she could keep it, then she would only pay $T - u(1 + r)$. But the fact that multiple refilings are possible allows her to indeed not pay $u(1+r)$ in taxes. The only added costs for not paying it would be that she has to pay the refiling costs twice (or more times, of course, if she refiles more than twice, but there's no need to assume she refiles more than twice), which are $2c$. So, her payoff would be $-(T - u(1 + r) + 2c)$. In the fourth situation, in addition of being able to not pay $u(1 + r)$ in taxes, she will not have to pay refiling costs. So, her payoff would be $-(T - u(1 + r))$. We assume that $2c < u(1 + r)$, which is a fairly reasonable assumption given that the under-reporting taxpayer chooses u.[7]

Table 3: Taxpayer payoffs under free multiple refiling

	Notification sent	Notification not sent
Reports true ITA	$-(T + c)$	$-T$
Under-reports ITA	$-(T - u(1 + r) + 2c)$	$-(T - u(1 + r))$

Therefore, the expected payoffs for reporting the true ITA and for under-reporting it

[7]The only restriction on the amount under-reported is that $u < T$. So, it seems fairly reasonable to assume the under-reporter will choose u so that $\frac{2c}{1+r} < u$. Note it implies assuming that $\frac{2c}{1+r} < T$ as well, which we do.

(moving forward, π^{tr} and π^{un}, respectively) are:

$$\pi^{tr} = -q(T+c) - (1-q)T = -qc - T \tag{1}$$

$$\pi^{un} = -p\,(T - u(1+r) + 2c) - (1-p)\,(T - u(1+r)) = -2pc - T + u(1+r) \tag{2}$$

From Equations (1)–(2) it follows that:

$$\pi^{tr} \lesseqgtr \pi^{un} \iff p \lesseqgtr \frac{q}{2} + \frac{u(1+r)}{2c} \tag{3}$$

However, given that $2c < u(1+r)$, it follows that $\pi^{tr} < \pi^{un}$ no matter how proficiently (or incompetently) tax authorities carry out their job. That is, $\pi^{tr} < \pi^{un}$ for any $p \in [0,1]$ and $q \in [0,1]$. Figure 1 left panel graphically shows this result. It has the positively sloped line $p(q) = \frac{q}{2} + \frac{u(1+r)}{2c}$ at which $\pi^{tr} = \pi^{un}$, which we label p^{mult} (for "multiple refiling"). Above p^{mult} it is the case that $\pi^{un} < \pi^{tr}$, so that reporting the true ITA is the expected payoff maximizing decision. Below p^{mult} it is the case that $\pi^{tr} < \pi^{un}$, so that under-reporting the ITA is the expected payoff maximizing decision. It could be seen that, within the $p \in [0,1]$ and $q \in [0,1]$ unit square area, it never occurs that $\pi^{un} < \pi^{tr}$.[8]

[8]Consider the case in which the IT is greater than the ITA. Note, first, that then $I = T + D$, in which I denotes the IT and $0 < D$ the amount in which the IT exceeds the ITA. Then: (i) if the taxpayer reports the true ITA but is notified, her payoff is $-(T + D + c)$; (ii) if she reports the true ITA and is not notified, her payoff is $-(T + D)$; (iii) if she under-reports the ITA and is notified (thus, she carries out the second refiling in which she under-reports again), her payoff is $-(T + D - ur + 2c)$ (the $0 < ur$ gain arising from the fact that she could invest the amount of ITA under-reported somewhere else at the interest rate r); and, (iv) if she under-reports the ITA and is not notified, her payoff is $-(T + D - ur)$. Therefore, her expected payoff for truthfully reporting is $\pi^{tr} = -q(T + D + c) - (1 - q)(T + D) = -qc - (T + D)$; and her expected payoff for under-reporting is $\pi^{un} = -p(T + D - ur + 2c) - (1 - p)(T + D - ur) = -2pc - (T + D) + ur$. From such expressions, it follows that

$$\pi^{tr} \lesseqgtr \pi^{un} \iff p \lesseqgtr \frac{q}{2} + \frac{ur}{2c}$$

The intuition of this worrisome result is, actually, straightforward. If accompanied by allowing taxpayers to refile multiple times, the sending notifications policy does not really take away from taxpayers the power to obtain benefits if they under-report; with those benefits being $u(1+r)$. Under-reporters will only have to pay the costs of refiling twice, $2c$. Thus, if the former are greater than the latter, the expected payoff maximizing decision would be to under-report. However, it is reasonable to assume that $2c < u(1+r)$, for the very reason that the taxpayer chooses u (see footnote 7).[9]

Now, consider the specific case in which $q = 0$, i.e., tax authorities never wrongly send notifications to truthful reporters as was the case in the Ecuadorian context our analysis is

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But, then, if $2c < ur$ then $\pi^{tr} < \pi^{un}$ for any $p \in [0,1]$ and $q \in [0,1]$. However, given that the taxpayer chooses u (with the only restriction that $u < T$), that $2c < ur$ seems a reasonable assumption to make.

[9]That taxpayers are risk-averse in the same degree for truth-reporting than for under-reporting can be modeled with the following utility function for each outcome i related to both reporting the truth and under-reporting: $U(i) = (A_i)^{1/a}$ with $1 < a$ integer (and odd, to have utilities which are always real numbers, because note that Table 3's payoffs related to truth-reporting are negative real numbers; while the payoffs related to under-reporting are most likely negative numbers). In this case:

$$U^{tr} = q\left(-T-c\right))^{1/a} + (1-q)(-T)^{1/a}$$
$$U^{un} = p\left(-T+u(1+r)-2c\right)^{1/a} + (1-p)\left(-T+u(1+r)\right)^{1/a}$$

From such expected utilities, it follows that

$$U^{tr} \lesseqgtr U^{un} \iff p \lesseqgtr q\frac{D}{E} + \frac{F}{E}$$

in which $0 < D = (-T)^{1/a} - (-T-C)^{1/a}$, $0 < F = (-T+u(1+r))^{1/a} - (-T)^{1/a}$, and $0 < E = (-T+u(1+r))^{1/a} - (-T+u(1+r)-2c)^{1/a}$. Let us label as p^{cr} (for "critical") to the function $p = q\frac{D}{E} + \frac{F}{E}$ (of course, above which $U^{un} < U^{tr}$ and below which $U^{tr} < U^{un}$). It is the case that $0 < \frac{D}{E} = \frac{\partial p^{cr}}{\partial q}$. But, then, if $1 <= \frac{F}{E} = p^{cr}(0)$ is the case, it follows that $U^{un} < U^{tr}$ for any $p \in [0,1]$ and $q \in [0,1]$ is also the case. And it can be verified that, from the assumption that $2c < u(1+r)$, it follows that $1 < \frac{F}{E}$. That is, even with risk-aversion utility functions we find that, no matter how proficiently (or incompetently) tax authorities carry out their sending (not sending) notifications policy, under-reporting is the expected utility maximizing decision.

It is worth noting that, if the degree of risk-aversion related to payoffs of under-reporting is greater than the degree of risk aversion related to under-reporting, then this result could no longer hold. Consider, for example, the scenario in which $U(i) = (A_i)^{1/a}$ for truth-reporting and $U(i) = (A_i)^{1/b}$ for under-reporting, with $1 < a < b$ integers and odd. In fact, in this scenario, if $a \to 1$ (the degree of risk aversion when truth-reporting is very small) and $b \to \infty$ (the degree of risk aversion when under-reporting is enormous), then $U^{un} < U^{tr}$ for any $p \in [0,1]$ and $q \in [0,1]$ would be the case.

based on. In this scenario:

$$\pi^{tr} \lesseqgtr \pi^{un} \iff p \lesseqgtr \frac{u(1+r)}{2c} \tag{4}$$

However, from the fact that $2c < u(1+r)$ it again follows that $\pi^{tr} < \pi^{un}$ no matter how proficiently (or incompetently) tax authorities send notifications to under-reporters; that is, for any $p \in [0,1]$ (including the case in which they never miss under-reporters: $p = 1$). Graphically, it could be seen in the left panel of Figure 1. It shows that the vertical intercept of p^{mult} is greater than one (specifically, $1 < \frac{u(1+r)}{2c} = p^{mult}(0)$).

The bottom line of this section's analysis is that, for selfish taxpayers, allowing free multiple refilings makes the notification policy plainly ineffective. This worrisome finding explains the title of this paper.[10]

4 Addressing the issue

4.1 Blocking free multiple refiling

To promote that truth-reporting becomes the expected payoff maximizing decision, a necessary first policy seems to be blocking multiple refilings. Importantly, this is what actually happened in Ecuador since 2013. Thus, assume now that only one free refiling is possible, by which we mean the following. If taxpayers under-report their ITA and receive a notification, then they will have only one chance to refile. Any additional refiling is not automatic, but

[10]It is worth mentioning that this result very likely holds even if $r = 0$. If $r = 0$, the condition under which $\pi^{tr} < \pi^{un}$ even if tax authorities always send notifications to under-reporters ($p = 1$) and never send notifications to truth-reporters ($q = 0$) is that $2c < u$. However, and again because such u is chosen by the under-reporting taxpayer (with the only restriction that $u < T$), it seems likely she would choose it so that $2c < u$ (assuming also, of course, that $2c < T$ is the case).

has to be formally and deeply reviewed by a tax official, who would easily find out any attempt to evade taxes, which will cause a fine.

Given this new institutional setup, Table 4 presents the selfish taxpayer's payoffs in the four possible situations she could end up. The big (and single) change with respect to Table 3 payoffs is in the situation in which she under-reports and the tax authority does send her a notification. In Table 4 it is given by $-(T + c)$ while in Table 3 it was given by $-(T - u(1 + r) + 2c)$. The reasons explaining this key change are the following. In the new institutional framework, the under-reporting taxpayer who does receive a notification has to choose between two options. First, she can under-report again in the refiling, in which case she will be caught and eventually fined and, therefore, will have to pay $T+c+f$, with $0 < f$ denoting the amount of the fine. Second, she can refile stating her true ITA, in which case she will avoid further issues and, thus, just pay $T + c$. But $-(T + c + f) < -(T + c)$ for any $0 < f$. Therefore, it is fair to assume she will choose the second option and, thus, have a $-(T + c)$ payoff.

Table 4: Taxpayer payoffs with one refiling

	Notification sent	Notification not sent
Reports true ITA	$-(T + c)$	$-T$
Under-reports ITA	$-(T + c)$	$-(T - u(1 + r))$

Therefore, the expected payoff for under-reporting the ITA is:

$$\pi^{un} = -p(T + c) - (1 - p)(T - u(1 + r)) = -pc - T + u(1 + r)(1 - p) \quad (5)$$

while the expected payoff for reporting the true ITA remains given by Equation (1). From

Equations (1)–(5) it follows that:

$$\pi^{tr} \lesseqgtr \pi^{un} \iff p \lesseqgtr \frac{cq}{c+u(1+r)} + \frac{u(1+r)}{c+u(1+r)} \tag{6}$$

From (6), it follows that $\pi^{un} < \pi^{tr}$ when tax authorities are proficient in sending notifications to under-reporters ($p \to 1$). This could be better grasped by noticing that, in the extreme case in which they always send notifications to under-reporters ($p = 1$), then reporting the true ITA is the expected payoff maximizing decision even if they also almost always wrongly send notifications to truth-reporters ($q \to 1$). Formally, if $p = 1$ then $\pi^{un} < \pi^{tr}$ for any $q \in [0, 1)$ (while, if $q = 1$, then $\pi^{un} = \pi^{tr}$).

Figure 1 right panel graphically shows these results. It has the positively sloped line $p(q) = \frac{cq}{c+u(1+r)} + \frac{u(1+r)}{c+u(1+r)}$ at which $\pi^{tr} = \pi^{un}$, which we label p^{one} (for "one refiling"), above/below which $\pi^{un} \lessgtr \pi^{tr}$ and, thus, truth-reporting/under-reporting the ITA is the expected payoff maximizing decision. It could be seen that, within the $p \in [0, 1]$ and $q \in [0, 1]$ unit square area, there's a subset in which actually $\pi^{un} < \pi^{tr}$, labeled A. The result that, for achieving such $\pi^{un} < \pi^{tr}$, it is key that tax authorities often send notifications to under-reporters can be seen by noting that area A includes all the points in which $p = 1$ and $q \in [0, 1)$, the same as the points in which $p \to 1$ even though $q \to 1$ too.

The intuition of this somewhat hopeful result is straightforward. Blocking multiple refilings blocks the possibility that under-reporters could easily keep $u(1 + r)$ instead of paying it as taxes. Now, they would pocket it only if they are lucky enough to not to receive a notification. If, in addition of it, the likelihood that they actually are notified is large enough, then reporting the true ITA could become the payoff-maximizing decision.

Now, consider the specific case in which $q = 0$, which happened in the Ecuadorian context our analysis is based on. In this scenario:

$$\pi^{tr} \lesseqgtr \pi^{un} \iff p \lesseqgtr \frac{u(1+r)}{c+u(1+r)} \tag{7}$$

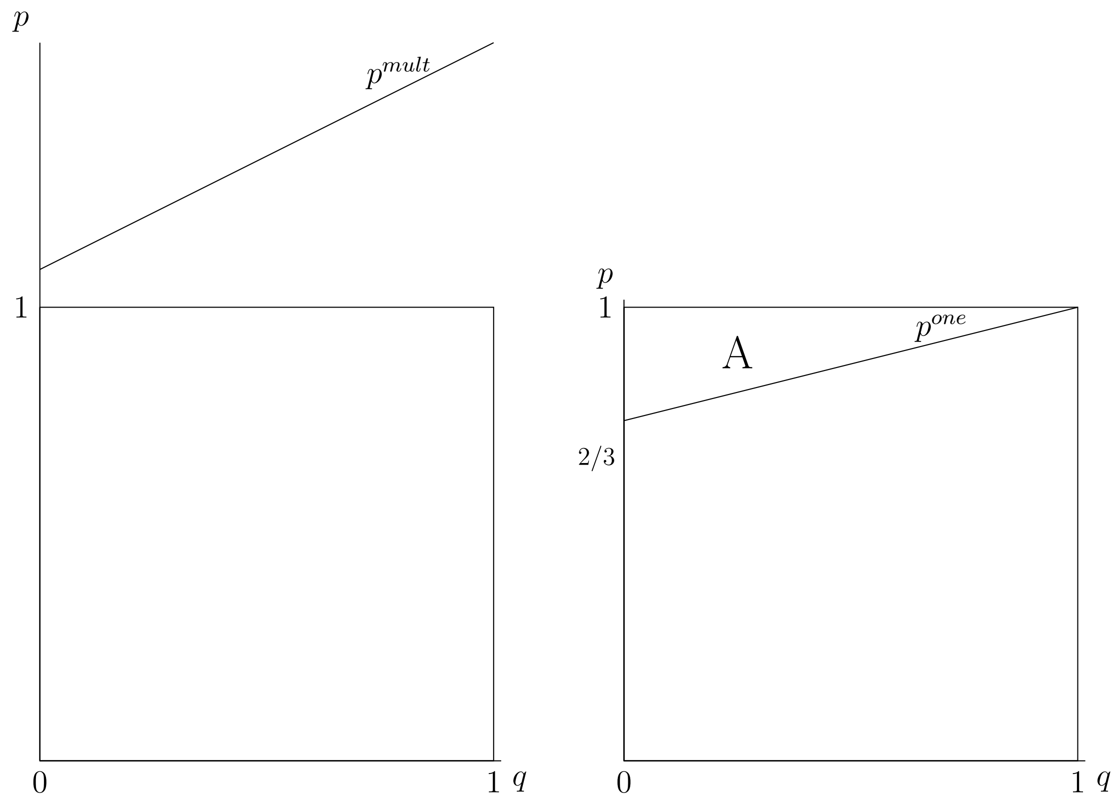
Given that $2c < u(1+r)$, it follows that $\pi^{un} < \pi^{tr}$ requires that $\frac{2}{3} < p$.

This finding is also graphically shown in Figure 1 right panel. It shows that the vertical intercept of p^{one} (above which we are in the desired area A) is greater than $\frac{2}{3}$ (i.e., $\frac{2}{3} < \frac{u(1+r)}{c+u(1+r)} = p^{one}(0)$). In other words, even if tax authorities never wrongly send notifications to truth-reporters, for the notification policy to have any chance to achieve the desired outcome, the probability that under-reporters are notified must be greater than $\frac{2}{3}$.[11]

In turn, this finding highlights the bottom line of this subsection's (4.1) analysis, which is that, in the presence of selfish taxpayers, blocking multiple refilings is a necessary but not a sufficient measure to achieve that truth-reporting is the expected payoff maximizing decision; for the latter, it is also needed that tax authorities do not often miss sending notifications to under-reporters.

[11] How much more depends on the actual amount in which $u(1+r)$ exceeds $2c$. For example, if $3c < u(1+r)$ then $\frac{3}{4} < p^{one}(0)$.

Figure 1: The scenarios under selfish preferences



(a) Free multiple refiling

(b) One refiling

4.2 Social preferences

There is however, a supplementary approach to foster that reporting the true ITA is the expected payoff maximizing decision. It is the presence of taxpayers who, instead of being exclusively selfish, exhibit social preferences. By it, we mean taxpayers who not only care about their strictly individual and monetary payoffs but they also positively care about the tax revenues raised by society in large (see footnote 2). A parsimonious way to model them is assuming that, when reporting their true ITA, in addition of obtaining some monetary payoffs, they also obtain a subjective gain for reporting the truth (so they actually contribute more if IT<ITA).[12] And, before proceeding, it is important to mention that, although it is beyond the scope of this paper to discuss how these preferences spread among society members (we simply assume they already exist to some extent), nevertheless, and as Fehr & Schmidt (2006, p. 617) say, the idea that "people often care about the well-being of others and that this may have important economic consequences" has been pointed out by an array of influential economists; including Smith (1759), Becker (1974), Arrow (1981), Samuelson (1993), and Sen (1995).[13]

Now, in order to assess the potential role of social preferences on taxpayers compliance, it is important to examine their presence both in the institutional framework in which multiple refilings are possible and in the institutional framework in which it is blocked. Beginning with the former, in this scenario Table 5 presents the taxpayer's payoffs under the four possible scenarios she could end up. It shows that, in all the situations in which she reports her true ITA (that is, regardless of receiving a notification or not) she obtains a gain $0 < s$. It is the parameter which captures her degree of social preferences (the larger s is the stronger they are). And we assume it such that, on the one hand, $u(1 + r) - 2c < s$ (i.e., social preferences are strong in this degree), but, on the other hand, $s < u(1 + r) - c$ (i.e., social

[12]Related to this modeling choice, two things are important to mention. First, we say this gain is subjective, in the sense it does not come from strictly monetary and individual wealth but it comes from the fact these agents feel they are contributing to a better society. However, it could eventually be an objective gain, if greater tax revenues actually translate into better public services these taxpayers would eventually enjoy. Second, an stronger version of the social preferences of our analysis would consist in having taxpayers who, in addition of (i) obtaining a subjective (perhaps eventually objective) gain when reporting their true ITA, they also (ii) obtain a subjective (perhaps eventually objective) loss when under-reporting it. This stronger version of taxpayer's social preferences would logically strengthen the case supporting truth-reporting. However, given it might imply that indeed truth-reporting is the expected payoff maximizing decision no matter how competently (or incompetently) tax authorities carry out their job (which in turn seems hard to believe) we prefer stick to the weaker version.

[13]Interestingly, if self-regarding and social preferences are complements or substitutes has also been investigated (Bowles & Hwang, 2008; Bowles & Polania-Reyes, 2012).

preferences are week in this degree).[14] Given this institutional and preferences framework, the reasons for which her payoffs when she reports her true IRA are those given in Table 5 are the following. In the situation in which she reports her true ITA and does receive a notification, in addition of having to pay $T + c$, she would obtain a gain s. Thus, her payoff would be $-(T + c - s)$. And in the situation in which she reports her true ITA and does not receive a notification, in addition of having to pay T she would obtain a gain s. Thus, her payoff would be $-(T - s)$. For their part, her payoffs if she under-reports are not different from those given in Table 3's (because of reasons explained more in the second comment of Footnote 12).

Table 5: Taxpayer payoffs with social preferences and free multiple refiling

	Notification sent	Notification not sent
Reports true ITA	$-(T + c - s)$	$-(T - s)$
Under-reports ITA	$-(T - u(1 + r) + 2c)$	$-(T - u(1 + r))$

Therefore, the expected payoff for reporting the true ITA is:

$$\pi^{tr} = -q(T + c - s) - (1 - q)(T - s) = -qc - T + s \tag{8}$$

while the expected payoff for under-reporting the ITA remains given by Equation (2). From Equations (2)–(8) it follows that:

$$\pi^{tr} \lesseqqgtr \pi^{un} \iff p \lesseqqgtr \frac{q}{2} + \frac{u(1 + r) - s}{2c} \tag{9}$$

[14]As it'll be seen below, if multiple refiling has been blocked, the assumption that social preferences are strong enough so that $u(1 + r) - 2c < s$ could be dropped.

Then, given that $u(1+r)-2c < s < u(1+r)-c$, the following mixed results follow. On the one hand, social preferences are strong enough so as to achieve that, if tax authorities often send notifications to under-reporters ($p \to 1$) and seldom send notifications to truth-reporters ($q \to 0$), then $\pi^{un} < \pi^{tr}$. However, on the other hand, social preferences are not strong enough so as to achieve that, if tax authorities always wrongly send notifications to truth-reporters ($q = 1$), then nevertheless $\pi^{un} < \pi^{tr}$ no matter how often they rightly send notifications to under-reporters (that is, if $q = 1$, then $\pi^{tr} < \pi^{un}$ for any $p \in [0, 1]$).[15]

Figure 2 left panel graphically shows these results. It has the positively sloped line $p(q) = \frac{q}{2} + \frac{u(1+r)-s}{2c}$ at which $\pi^{tr} = \pi^{un}$, which we label $p^{soc,mult}$ (for "social preferences with multiple refilings") above/below which $\pi^{un} \lesseqgtr \pi^{tr}$ and, thus, truth-reporting/under-reporting the ITA is the expected payoff maximizing decision. It could be seen that, within the $p \in [0, 1]$ and $q \in [0, 1]$ unit square area, there's a subset in which actually $\pi^{un} < \pi^{tr}$, labeled B. The result that social preferences help to achieve that truth-reporting is expected payoff maximizing but it also requires that the tax authority carries out its job proficiently can be seen by noting that area B includes the points in which $p \to 1$ and $q \to 0$. For its part, the result that $\pi^{un} < \pi^{tr}$ cannot occur if $q = 1$ (no matter how close to 1 or even equal to 1 for its part p is) can be seen by noting that area B does not include any point on the vertical line $q = 1$.

The intuition of these mixed results are straightforward. Related to the hopeful for tax compliance result, the intuition is as follows. If the taxpayer who reports her true ITA

[15] It is worth mentioning that, in the institutional framework in which multiple refilings are possible, that $u(1+r)+c < s$ would be the condition under which $\pi^{un} < \pi^{tr}$ no matter how incompetently (or competently) the tax authority carries out its job (that is, for any $p \in [0, 1]$ and $q \in [0, 1]$). But, of course, the assumption that $s < u(1+r) - c$ rules out that $u(1+r) + c < s$.

obtains a gain s which is greater than $u(1+r)-2c$, regardless of whether she wrongly gets a government's notification or not, then it is possible that reporting the true ITA is her expected payoff maximizing decision even if she can still do multiple refilings. However, for that to be case, and precisely because free multiple refilings are allowed, it is also needed that tax authorities often send notifications to under-reporters and seldom send notifications to truth-reporters. For its, part, the intuition of the sobering result is the following. If the gain s the truth-reporter obtains is smaller than $u(1+r)-c$, she will nevertheless for sure get a notification, and she can also do multiple refilings, then under-reporting will be her expected payoff maximizing decision.

Now, consider the specific case in which $q = 0$, which happened in the Ecuadorian context our analysis is based on. In this scenario:

$$\pi^{tr} \lesseqgtr \pi^{un} \iff p \lesseqgtr \frac{u(1+r)-s}{2c} \tag{10}$$

Given that $s < u(1+r)-c$, it follows that $\pi^{un} < \pi^{tr}$ requires that $\frac{1}{2} < p$.

This finding is also graphically shown in Figure 2 left panel. It shows that the vertical intercept of $p^{soc,mult}$ (above which we are in the desired area B) is greater than $\frac{1}{2}$ (i.e., $\frac{1}{2} < \frac{u(1+r)-s}{2c} = p^{soc,mult}(0)$). In other words, even if tax authorities never wrongly send notifications to truth-reporters, for the notification policy to have any chance to achieve the desired outcome, the probability that under-reporters are notified must be greater than $\frac{1}{2}$.[16]

Passing now to the institutional and preferences framework in which, in addition of having

[16]How much more depends on the actual amount in which s is smaller than $u(1+r)-c$. For example, if $s < u(1+r)-\frac{4}{3}c$, then $\frac{2}{3} < p^{soc,mult}(0)$.

taxpayers with social preferences, multiple refilings are blocked, in this scenario Table 6 presents the taxpayer's payoffs under the four possible scenarios she could end up. It shows that, if the taxpayer reports her true ITA, her payoffs are the same as those given in Table 5 while, if she under-reports, her payoffs are the same as those given in Table 4.

Table 6: Taxpayer payoffs with social preferences and one refiling

	Notification sent	Notification not sent
Reports true ITA	$-(T+c-s)$	$-(T-s)$
Under-reports ITA	$-(T+c)$	$-(T-u(1+r))$

Therefore, the expected payoff for reporting the true ITA is given by Equation (8) while the expected payoff for under-reporting the ITA is given by Equation (5). From Equations (5)–(8), it follows that:

$$\pi^{tr} \lesseqqgtr \pi^{un} \iff p \lesseqqgtr \frac{cq}{c+u(1+r)} + \frac{u(1+r)-s}{c+u(1+r)} \tag{11}$$

Then, the following results follow. First, for any positive degree of social preferences, $\pi^{un} < \pi^{tr}$ occurs if tax authorities carry out their job fairly well. That is, provided such competent tax authority exists, it is no longer needed that social preferences are strong enough so that $u(1+r) - 2c < s$ but any $0 < s$ suffices for truth-reporting to become the expected payoff maximizing decision. Second —and perhaps most importantly— the subset of the tax authority's performances which achieve that $\pi^{un} < \pi^{tr}$ is the greatest of the four institutional and preferences scenarios we have examined (selfish preferences with and without free multiple refilings and social preferences with and without free multiple refilings).

Figure 2 right panel graphically shows the latter result. It has the positively sloped line $p(q) = \frac{cq}{c+u(1+r)} + \frac{u(1+r)-s}{c+u(1+r)}$ at which $\pi^{tr} = \pi^{un}$, which we label $p^{soc,one}$ (for "social preferences and one refiling"), above/below which $\pi^{un} \lesseqgtr \pi^{tr}$ and, thus, truth-reporting/under-reporting the ITA is the expected payoff maximizing decision. It could be seen that, within the $p \in [0,1]$ and $q \in [0,1]$ unit square area, there's a subset in which actually $\pi^{un} < \pi^{tr}$, labeled C. Comparing it with area B of Figure 2 left panel, it could be seen that C is greater.[17] Furthermore, comparing C with area A of Figure 1 right panel, it could be seen that the former is greater as well.[18] These comparisons show that, among the four institutional and preferences scenarios we have examined, that one in which there are social preferences and multiple refilings are blocked gives rise to the greatest variety of a tax authority's performances which make that truth-reporting is expected payoff maximizing.

The intuition of this hopeful for tax compliance result is straightforward. To begin with, blocking free multiple refilings reduces the expected payoff of under-reporting. In addition, social preferences increase the expected payoff of truth-reporting. Under the combined impact of both effects, reporting the true ITA could become the expected payoff maximizing decision even if the tax authority doesn't carry out its job that proficiently.

Now, consider the specific case in which $q = 0$, which occurred in the Ecuadorian case in

[17] Formally, we can unequivocally conclude that C is greater than B because (given that $2c < u(1+r)$) both (i) $p^{soc,one}(0) = \frac{u(1+r)-s}{c+u(1+r)} < \frac{u(1+r)-s}{2c} = p^{soc,mult}(0)$ and (ii) $p^{soc,one}(1) = \frac{c+u(1+r)-s}{c+u(1+r)} < \frac{1}{2}(\frac{c+u(1+r)-s}{c}) = p^{soc,mult}(1)$ are the case.

[18] Formally, we can unequivocally conclude that C is greater than A because (given that $0 < s$) both (i) $p^{soc,one}(0) = \frac{u(1+r)-s}{c+u(1+r)} < \frac{u(1+r)}{c+u(1+r)} = p^{one}(0)$ and (ii) $p^{soc,one}(1) = \frac{c+u(1+r)-s}{c+u(1+r)} < \frac{c+u(1+r)}{c+u(1+r)} = p^{one}(1)$ are the case.

which our analysis is based on. In this scenario:

$$\pi^{tr} \lesseqgtr \pi^{un} \iff p \lesseqgtr \frac{u(1+r)-s}{c+u(1+r)} \tag{12}$$

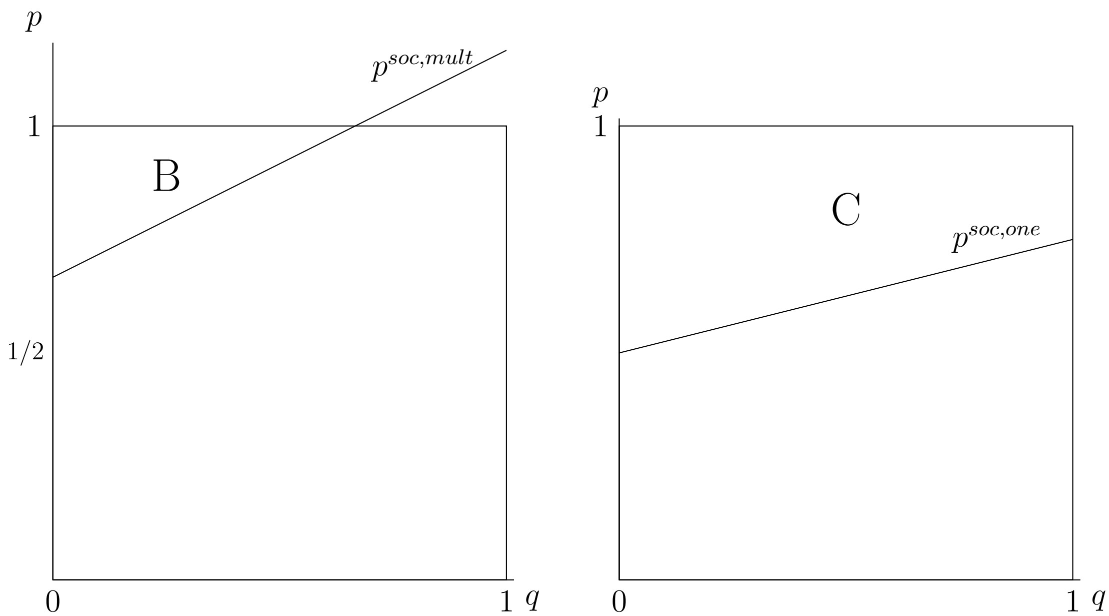
It follows that, if $p \in (0,1)$ is high enough, then $\pi^{un} < \pi^{tr}$. Specifically, if $\frac{u(1+r)-s}{c+u(1+r)} < p$, then $\pi^{un} < \pi^{tr}$; which is an smaller requirement than the one which was the case when multiple refilings were allowed.

This finding is also graphically shown in Figure 2. It shows that the (right panel's) vertical intercept of $p^{soc,one}$ is smaller than the (left panel's) vertical intercept of $p^{soc,mult}$ (specifically, $p^{soc,one}(0) = \frac{u(1+r)-s}{c+u(1+r)} < \frac{u(1+r)-s}{2c} = p^{soc,mult}(0)$). In other words, to achieve that truth-reporting is the expected payoff maximizing choice, tax authorities should often send notifications to under-reporters but not as often as in the institutional framework in which multiple refilings are allowed.[19]

It is also worth highlighting that, not surprisingly, $p^{soc,one}(0) = \frac{u(1+r)-s}{c+u(1+r)}$ is inverse function of s. Related to it, it's worth finishing our analysis by obtaining some flavor of the values of such function. We do so in Table 7 for a few values. In it, each row of its right column shows the value of $p^{soc,one}(0)$ which follows from the s (in terms of $u(1+r)$ and c) given in the left column. And it could be seen that, as s increases, then $p^{soc,one}(0)$ decreases.

[19]Note, by the way, that in Figure 2 right panel we draw the specific case in which $p^{soc,one}(0) \approx \frac{1}{2}$, which in turn is the case if $s \approx \frac{1}{2}\left(u(1+r)-c\right)$.

Figure 2: The scenarios with social preferences



(a) Free multiple refiling (b) One refiling

Table 7: Degree of social preferences and $\mathbf{p^{soc,one}(0)}$

Degree of social preferences (s)	$p^{soc,one}(0)$
$\frac{1}{10}u(1+r) - \frac{9}{10}c$	$\frac{9}{10}$
$\frac{1}{5}u(1+r) - \frac{4}{5}c$	$\frac{4}{5}$
$\frac{1}{4}u(1+r) - \frac{3}{4}c$	$\frac{3}{4}$
$\frac{2}{5}u(1+r) - \frac{3}{5}c$	$\frac{3}{5}$
$\frac{1}{2}\left(u(1+r) - c\right)$	$\frac{1}{2}$
$\frac{3}{5}u(1+r) - \frac{2}{5}c$	$\frac{2}{5}$
$\frac{3}{4}u(1+r) - \frac{1}{4}c$	$\frac{1}{4}$
$\frac{4}{5}u(1+r) - \frac{1}{5}c$	$\frac{1}{5}$
$\frac{9}{10}u(1+r) - \frac{1}{10}c$	$\frac{1}{10}$

5 Conclusions

In this paper we analyze both empirically and theoretically the role of multiple refilings on tax compliance. We use the context of the use of tax notifications to control the evasion of the income tax advance in Ecuador, and document the use of multiple refilings to evade taxes in that country. Building upon this background, we develop a model to study the behavior of taxpayers under different institutional and preferences scenarios.

First, we assume that taxpayers exhibit exclusively selfish preferences and that multiple refilings are allowed. The key (and worrisome) finding in this scenario is that, independently of the efficiency of the tax authority to correctly notify the evaders and not to notify compliers, the expected payoff maximizing decision is to evade taxes.

Second, we assume multiple refilings are blocked but taxpayers are still exclusively selfish. The finding in this scenario is that complying to pay taxes is the payoff maximizing decision as long as the tax authority is strongly efficient notifying evaders (it has to do so with a greater than $\frac{2}{3}$ likelihood). That is, blocking multiple refilings is a necessary but not sufficient condition to achieve compliance.

Third, we consider the scenario in which taxpayers exhibit social preferences (in the sense they nicely, so to speak, care about social welfare; see Footnote 2) and multiple refilings are allowed. The finding under this scenario is that there will be compliance, because social preferences foster such decision, but only if the tax authority delivers the tax notifications efficiently (does not miss under-reporters that often and does not notify truth-reporters).

Our last scenario assumes that taxpayers exhibit social preferences and that multiple refilings are blocked. The finding in this scenario is that there will be compliance for a broader range of parameters. The need of having an efficient tax authority (i.e., consistently notifies evaders and does not notify compliers) remains but is less stringent the stronger the social preferences are.

Overall, our results imply that blocking the use of multiple refilings reduces the expected payoff of evasion and therefore reduces the probability of evasion. We also find that social preferences help reducing tax evasion and therefore that the proliferation of society-regarding preferences should be promoted.

Our results imply a simple policy recommendation that consist on limiting the option of multiple refilings in the context of tax evasion control. More generally, the results call for carefully design evasion control policies that are compatible with the incentives of taxpayers.

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