Social programs as positive inducements for tax participation

James Alm, **Todd L. Cherry**, Michael Jones, Michael McKee

Abstract
A significant amount of non-compliance with the personal income tax is due to individuals who have not filed a tax return and so who are not "in the system". We use experimental laboratory methods to examine the effect of positive inducements for filing a tax return. Our design captures the essential features of a voluntary income reporting and tax assessment system: human participants earn income, they must decide whether to file a tax return, and, conditional upon filing, they must choose how much income to report. Taxes are paid on reported income only. Unreported income of filers may be discovered via a random audit, and the participant then pays owed taxes plus a fine. Inducements for filing are introduced as treatments: a social safety net (e.g., unemployment replacement income) that is conditional upon past filing behavior, and a tax credit that is available only to those who file. Our results suggest that an untargeted tax credit can encourage participation, but that targeting the credit to low income earners offers a stronger inducement to file. Also, the provision of a social safety net via unemployment benefits has a positive, albeit an indirect, impact on participation.

Keywords
Tax evasion; Tax compliance; Behavioral economics; Experimental economics

1. Introduction

A significant amount of non-compliance associated with the individual income tax in many countries is due to the taxpayers who are not "in the system," not having filed a tax return in the recent past or perhaps ever. Of course, individuals with taxable income are in most countries required to file a tax return, at least if their income exceeds some threshold level. However, many individuals ignore this legal requirement, choosing instead to take their chances in the tax compliance game by not filing a return. In this regard, individuals are often encouraged in their non-filing because enforcement mechanisms are typically tied to the existence of a tax return. This administrative feature makes non-filing especially attractive: a non-filer avoids the financial burden of calculating and paying taxes while simultaneously reducing the probability of detection, sometimes to zero. Cowell (1990) and Erard and Ho (2001) have referred to those who do not file as "ghosts". This phenomenon is most prevalent among individuals who receive income not subject to third-party reporting or withholding.[1] While the amounts owed by such taxpayers on their incomes are often individually small, the aggregate amount contributes substantially to the tax gap.[2] For policy makers, the task is encouraging these individuals to file a tax return. This paper uses experimental laboratory methods to examine positive inducements for tax filing.

The traditional policy response has relied upon greater penalties for non-compliance. However, while audits and fines may be useful instruments for encouraging more reporting by those who already file a tax return (i.e., *reporting* compliance), these tools are largely ineffective in capturing non-filers (i.e., *filing* compliance) because enforcement is in most circumstances directed only at individuals who have filed a return (Erard and Ho, 2001). Positive inducements may be more effective in this regard. However, their impact is unknown.

The tax system offers some potential avenues for encouraging tax filing via positive inducements. One prominent class of policies is the receipt of direct benefits under various transfer programs for which all citizens are eligible. Included here are programs broadly classified as "social insurance", such as unemployment insurance. The receipt of benefits associated with these programs can encourage tax filing, since filing a return may be made a condition for eligibility and since past tax filings may be used to determine benefits.

The use of tax credits is a more targeted approach. These programs often provide tax credits that are conditional upon filing, which thereby create incentives for individuals to participate in the tax system. The U.S. earned income tax credit (EITC) is a prominent example of this program type. The provisions of the EITC restrict participation to relatively low income earners, with the bulk of benefits going to families with children. However, the forms required to claim the EITC are somewhat complicated, and this feature has probably led to lower participation.[3] Audit procedures under the program impose an additional cost on participants, which may have further reduced participation among this class of taxpayers; indeed, there has been targeted auditing of those filing for the credit. Even so, a significant percentage of EITC participants would be outside the tax system in the absence of the program (Scholz, 1994 and Kopczuk and Pop-

Eleches, 2007). The child care expense tax credit is another example of a targeted tax credit that encourages filing.

The difficulty in assessing the effects of such policies is an obvious one: any such effects depend on the behavioral responses of individuals currently not filing tax returns and so not currently observable by the tax authority. *Under-reporting* behavior of individuals who file a return is notoriously difficult to observe in the field; *non-filing* behavior is even more hidden. Indeed, studies of non-filing using field data are sparse. One study by Crain and Nourzad (1993) compared the characteristics of those who evade taxes while filing versus those who choose simply to not file. The Internal Revenue Service (IRS) has also conducted studies of delinquent returns to ascertain factors specific to non-filers (Graeber et al., 1992). The most comprehensive study of non-filing was by Erard and Ho (2001), who used IRS information to estimate the factors that affect non-filing.

As with all studies based on field data, however, these studies suffer from various difficulties, from being forced to contend with various econometric issues (e.g., the endogeneity of audit selection arising from budgets for audit activities), from not always having direct measures of non-compliance (e.g., the use of reported income, not unreported income), and especially from the inability to control for all variables that might affect taxpayer decisions (e.g., changes in the tax laws, taxpayer attitudes, economic conditions). Further, there are few changes in the rules for tax credits and/or income support programs, and those few changes are often confounded with other effects such as changes in macroeconomic conditions.

Since it is the behavioral responses of individuals whom the tax authority cannot directly observe that are of interest, the laboratory is a natural arena to investigate the effects of policies aimed at increasing tax participation. Although there are numerous experimental studies that examine behavioral responses of those individuals who already file a tax return (Becker et al., 1987, Webley et al., 1991, Alm et al., 1992a, Alm et al., 1993 and Cummings et al., 2009), there are no experimental analyses of filing behavior, in which subjects have the option to file or not to file a tax return. There are also no analyses of the effects of positive inducements on filing behavior.

Accordingly, our research here is directed at assessing the behavioral effects on filing of providing incentives for an individual to file a return, where these benefits are received only if the taxpayer files a return. To examine these responses, we introduce in a controlled laboratory setting various positive filing inducements, including social safety nets (e.g., unemployment replacement income) and income tax credits that are given either to low income participants or to all income levels. In both cases, benefits are available only to those who file a tax return. We find evidence that an untargeted tax credit can encourage participation, but that targeting the credit to low income earners offers a stronger inducement to file. We also find that the provision of a social safety net via unemployment benefits has a positive, albeit an indirect, impact on participation. In the process, our framework provides a more general–and a more realistic–analysis of

individual compliance decisions because we incorporate both the *filing* and the *reporting* decisions.

2. The filing versus the reporting decision

The traditional theoretical development of the *reporting* decision typically begins with the assumption that the individual has already chosen to file a return. Following Becker (1968), evasion is then modeled as a gamble in which the states of nature are being caught or not being caught and, if caught, a fine is assessed (Allingham and Sandmo, 1972). The individual decides only the amount of income to report and so the amount to evade, and a rational individual is viewed as maximizing the expected utility of the tax evasion gamble, weighing the benefits of successful cheating against the risky prospect of detection and punishment. The individual reports income and pays taxes because he or she is afraid of getting caught and penalized if he or she does not report all income. This approach gives the plausible result that compliance depends upon audit rates and fine rates. Indeed, the central point of this approach is that an individual pays taxes because – and *only* because – of the fear of detection and punishment.

However, the *filing* decision is also of interest, and has seldom been examined. To the extent that the tax administration is unaware of non-filers, they face little or no risk of being selected for audit, so that the traditional policy response of increased enforcement efforts is not particularly effective. Indeed, the traditional Allingham and Sandmo (1972) analysis of the *reporting* decision do not fully capture the elements of the individual's *filing* decision because submitting a tax return with underreported liabilities is inherently different from failing to submit a return at all. [7] Evasion while reporting raises the specter of an audit; an individual who has not filed a return may be exposed to a much lower risk of audit. However, if the individual who has not filed a return is in fact detected as having not filed, there may be additional penalties. The tradeoff is a lower probability of detection for non-filing versus a higher penalty for detected non-filing. For this *filing* decision, the individual must compare the expected utility from filing versus the expected utility from non-filing, where an individual who files must also then determine the amount of income to report on the return.

Erard and Ho (2001) discuss and analyze these issues, by expanding the traditional model to include both the *filing* and the *reporting* compliance decisions. They construct a sequential decision that includes such steps as the choice of income withholding, the decision to file, and the reporting decision. In their framework, the decision to file or not is influenced by the costs of filing, the probability of being identified as a non-filer, and the penalties for not filing. To these, one should also incorporate the potential benefits from such tax credits as may exist (e.g., the EITC) and/or the existence of a social safety net, both of which may be conditional on prior tax filings and both of which represent positive inducements to file. [8] In this expanded framework, it is straightforward to show that an increase in the tax credit or in the level of income support increases the return to filing a tax return, other things equal. Other variables (e.g., the tax rate, the fine rate) have more complicated effects. It is the positive inducements for filing from tax credits and income support programs that our experimental design investigates.

3. Experimental design

3.1. General experimental features

The experimental design captures the essential features of the voluntary income reporting and tax assessment system used in many countries. Human participants in a controlled laboratory environment earn income through their performance in a task. The participants must decide first whether to file a tax return and then, conditional upon filing a return, how much of this income to report to a tax agency. Taxes are paid on reported income only. If an individual files a return, any unreported

Fig. 1. Tax form after completion by subject and before filing.

income may be discovered via a random audit, and the individual must then pay the owed taxes plus a fine based on the unpaid taxes. The probability of detection if the individual does not file is set at zero, to reflect the fact in most countries that an individual who does not file faces no effective chance of detection.[9] Subjects are fully and accurately informed about the various features of the experimental setting (e.g., tax rates, penalty rates, audit rates, tax form costs, tax credits, unemployment benefits, and the like). This income earning, income reporting, audit, and penalty process is repeated over a number of rounds each representing a tax period. At the completion of the experiment, all participants are paid in cash their laboratory market earnings converted to U.S. dollars.

Participants are recruited from the pool of undergraduate students and staff at a major public university using the Online Recruiting System for Experimental Economics (ORSEE) developed by Greiner (2004). Upon arrival at the laboratory, participants are assigned to a computer station with each station being situated in an isolation carrel. The lab server assigns participants to groups (consisting of 7–10 persons depending on

the total number of participants in the session) and there are always two groups in a session to implement anonymity. Basic instructions are provided via a hardcopy and also via a series of screen images; see the Appendices for representative instructions and Fig. 1 and Fig. 2 for representative screen images.[10] There is no interaction between the participants and the person running the experiment beyond the initial seating of the participants at terminals and the reading of the consent sheet. Decisions are made privately and participants are not allowed to communicate with one another during the session; participants also do not sign consent forms to further increase anonymity. Participants are informed (via the consent sheet) that all responses are anonymous, that no individual identification will be collected, and that the only record of participation will be the receipt signed to receive payment at the end of the session. Participants are told (via the instructions) that payments will be made in private at the end of the session. Since payoffs depend on multiple decisions made by each participant as well as on the random audit process, the person making the payments cannot assess participant decisions from the level of the aggregate payoffs at the end of the session. Taken together, these experimental procedures effectively eliminate both subject-to-subject interaction and subject-to-experimenter interaction.
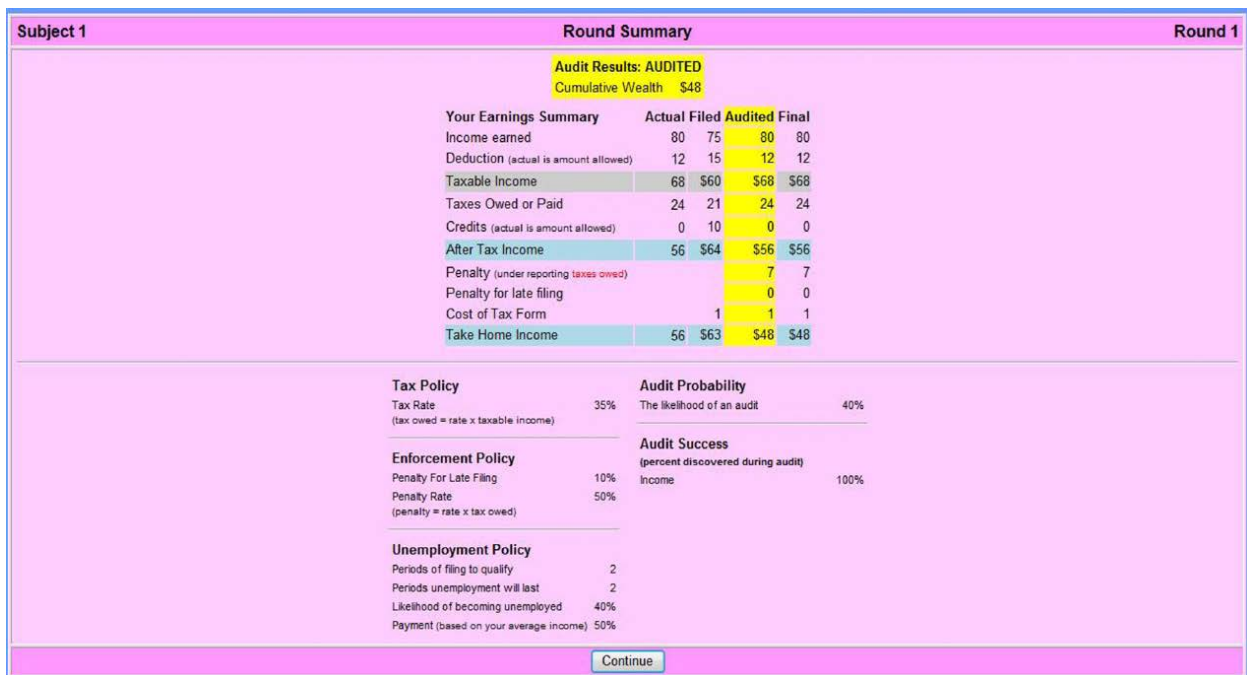
Subject 1		Round Summary				Round 1

Audit Results: AUDITED
Cumulative Wealth $48

Your Earnings Summary	Actual	Filed	Audited	Final
Income earned	80	75	80	80
Deduction (actual is amount allowed)	12	15	12	12
Taxable Income	68	$60	$68	$68
Taxes Owed or Paid	24	21	24	24
Credits (actual is amount allowed)	0	10	0	0
After Tax Income	56	$64	$56	$56
Penalty (under reporting taxes owed)			7	7
Penalty for late filing			0	0
Cost of Tax Form		1	1	1
Take Home Income	56	$63	$48	$48

Tax Policy
Tax Rate — 35%
(tax owed = rate x taxable income)

Enforcement Policy
Penalty For Late Filing — 10%
Penalty Rate — 50%
(penalty = rate x tax owed)

Unemployment Policy
Periods of filing to qualify — 2
Periods unemployment will last — 2
Likelihood of becoming unemployed — 40%
Payment (based on your average income) — 50%

Audit Probability
The likelihood of an audit — 40%

Audit Success
(percent discovered during audit)
Income — 100%

Continue

Fig. 2. End-of-round summary screen with audit results (if any).

Participants are not told the exact duration of the experimental session, which is predetermined to last for 20 real rounds. Including instruction, three practice rounds, and the 20 real rounds, sessions take on average 70 min to complete. Participant earnings range from $16 to $38, depending upon task earnings, filing and reporting behavior, and audit experience.

The detailed steps of the experiment can be briefly described. The earnings task requires the participants to sort randomly arranged digits. The task is timed, with the

fastest person in the group earning the highest payment and the slowest the least payment. Earnings range from 100 lab dollars down to 10 lab dollars in increments of 10 lab dollars.

Once all participants have completed the income task, they are informed via the computer of their income for the round, and are then presented with a screen that provides the details of the tax policy in effect. Here they are informed of the tax rate, the audit probability, and the penalty rate on discovered evasion, as well as the details of the treatment policy intervention. The tax form is not yet provided. This feature simulates the need for the participant to collect the information needed to file a return. Participants may choose to get a form or not, and there is a tax form cost (reflective of the overall costs of tax filing) that varies from 0 to 2 lab dollars. If the participant chooses not to obtain a tax form, then they do not file and are not subject to an audit in the current round. This feature mirrors the typical feature of tax systems that individuals who do not file a return face a significantly lower (often zero) chance of audit. If the participant chooses to get the form, then the cost is deducted from the participant's income for the round. If the participant has obtained the form, he or she may still choose to not file by selecting the "Not File" button on the tax form screen. Since the tax filing season is limited in the field, there is a time limit imposed (75 s) in the experiment, and a counter at the bottom of the tax form informs the participants of the time remaining. If the time expires and a tax form has not been filed, then the participant is automatically audited and an additional 10 percent penalty is imposed. Since the "Not File" button is always available, the timer simply imposes the requirement that a decision be recorded within the time limit.

The process of determining who is audited is generated by a computerized draw. After the return is filed, the participants are presented with an animated (computerized) representation of a bucket from which a draw is made. In this bucket there are 10 balls (either blue or white) with a white ball signifying no audit and a blue ball denoting an audit. Each taxpayer is audited independently. The balls "bounce" in this bucket, and, after a randomly determined interval, a door opens and a ball exits the bucket through this door. The color indicates whether the individual is audited. Participants choosing not to file a tax return are presented with a screen that informs them that they will not be audited in the current round. Subjects know only the result of their own audit process and not the results for the other subjects. After the audit process has been completed, the taxpayers are presented with a new screen that provides the earnings and audit outcome summary for the round.

At the end of the session, the participants complete a short questionnaire in which they report their age, gender, and whether they prepare and file their own taxes (a measure of their direct experience with the tax system).

Table 1. No inducement treatment (NIT) settings.

Treatment	Tax rate	Audit probabilities	Penalty rate	Income range	Form cost
NIT	35%	0.4, 0.3, 0.4	150%	10–100	2, 1, 0

Table 2. Income tax credit treatment (CRT) settings.

Treatment	Credit equation
CRT1	$CR = 20 - 0.2 \times X$ (income tax credit)
CRT2	$CR = 30 - 0.6 \times X$ (low income tax credit)

Notes: The credit equation reports amount of the credit (CR), the intercept (i.e., the base credit), and the reduction in the credit as income (X) increases. Basic parameters (i.e., the tax rate, the audit probabilities, the penalty rate, the income range, the form cost) are the same as in the NIT settings.

3.2. Experimental treatments

Our objective is to examine the effects of positive inducements to file a tax return. To establish a baseline, we conduct sessions in which positive inducements are absent but in which the other features of the tax filing regime are incorporated. The "No Inducement Treatments" (denoted "NIT") are described in Table 1. The tax rate is set at 35 percent throughout all sessions, and the audit probabilities are set at 0.3 or 0.4, with two values in use in each session. The audit rate is set for the first 8 rounds, changes for the second 8 rounds, and reverts to the original level for the final 4 rounds. Thus, in Table 1, the audit rates for NIT are 0.4 for 8 rounds, 0.3 for 8 rounds, and 0.4 for the final 4 rounds. Participants are instructed that the audit rate may change during the course of the session, but they are not told the specific pattern.

The first set of positive filing inducements consists of tax credits targeted at lower income taxpayers. This targeting is typically motivated by equity concerns, but it has the collateral effect of addressing a specific set of "ghosts", or those with lower incomes who may well be earning incomes that are not matched by employer records submitted to the tax authority. In another tax credit treatment all subjects are eligible for the credit. For the credit treatments, the participants are informed of the level of the tax credit that they are eligible to receive and that receipt of this amount is conditional upon filing a tax return. The two tax credit settings are shown in Table 2 as CRT1 and CRT2, where "CRT" denotes "credit treatment" and where the key difference between these treatments is the targeting of the income tax credit to lower income earners in CRT2. For example, in CRT1 ("income tax credit") the formula for the credit CR is $CR = 20 - 0.2 \times X$, where X is the amount of earned income and the base credit is 20 lab dollars. If the participant earns, say, 60 lab dollars, then the credit is 8 lab dollars; the credit goes to zero when the participant has earned 100 lab dollars, which is the maximum income level possible. In the "low income tax credit" CRT2, the formula is $CR = 30 - 0.6 \times X$, so the base credit is set at 30 lab dollars and the credit drops to zero when the participant has earned 50 lab dollars.

The other positive inducement is the presence of an income support program that pays benefits in the event of the individual becoming unemployed. The parameters for this series of sessions are shown in Table 3, where "UBT" denotes "unemployment benefits treatment". Participants are informed of the probability of being unemployed, the duration of unemployment, and the income support they are eligible to receive; again, they are told that receipt is conditional upon filing and upon the level of income that is reported on these filings. The probability of unemployment is determined by a random draw for each participant, and equals either 20 percent or 40 percent. The unemployment benefits are determined as follows. The number of filing periods for eligibility is stated in the instructions as 2 periods, and the benefit is a stated 50 percent

of the average of the incomes reported on filing during the periods required for eligibility. (We also combine unemployment benefits with the low income tax credit in some sessions.) During the periods of unemployment, the participant does not have the opportunity to earn income (and the income earning task screen is suppressed). Instead, subjects are presented with a screen informing them that they are unemployed and that this is round x of unemployment period of duration y. The unemployment benefits are assumed to be taxable. If the participant files a tax return reporting their unemployment benefit income, then they are subject to the normal audit process; if the participant chooses to not file, then they are not audited.

3.3. Expected value calculations

It is useful to calculate the expected value of the compliance gamble in the various treatments. For example, in the baseline (or NIT) sessions, the expected value from filing a tax return $EV(Filing)$ equals $[(1 − p)(I − tX − C) + p(I − tX − (1 + f)t(I − X) − C)]$, where p is the probability that a tax return is selected for audit, t is the tax rate on reported income, f is the penalty rate on

Table 3. Unemployment benefits treatment (UBT) settings.

Treatment	Probability of unemployment	Percentage benefits	Required filing periods
UBT	0.4 and 0.2	0.5	2

Notes: Basic parameters (i.e., the tax rate, the audit probabilities, the penalty rate, the income range, the form cost) are the same as in the NIT settings.

Table 4. Descriptive statistics.

Variable	Mean	Standard deviation
Form cost (lab $)	0.566	0.779
Audit probability	0.349	0.056
Income tax credit (yes = 1)	0.204	0.403
Low income tax credit (yes = 1)	0.298	0.458
Unemployment benefits (yes = 1)	0.353	0.478
Form obtained (yes = 1)	0.704	0.457
Form filed (yes = 1)	0.675	0.468
Reported full|form filed (yes = 1)	0.829	0.377
Income (lab $)	49.846	31.458
Age (years)	29.807	13.572
Sex (male = 1)	0.410	0.492
Number of observations	4324	

undeclared taxes, I is the individual's "true" income, X is the amount of reported income, and C is the tax form cost. When $p = 0.3$, $t = 0.35$, $f = 0.5$, and $C = 0$, $EV(Filing)$ equals 65 for $I = 100$ and $X = 100$. In contrast, the expected value from non-filing $EV(Non-filing)$ equals $[(1 − q)I + q(I − (1 + f)tI)]$, where q is the probability that an individual who has not filed a return is apprehended by an audit. Given parameter values (mainly $q = 0$), the expected value from non-filing equals 100. In general, there is no incentive for individuals to file in the NIT sessions, even for different levels of reported income.

However, the presence of positive inducements can give individuals a strong incentive to file a return. For example, an individual receiving the low income tax credit (CRT2) who files a tax return with zero reported income has an expected value of 114.25, a

level well above $EV(Non\text{-}filing)$. Similar incentives for filing are present for the general income tax credit (CRT1) and the unemployment benefits (UBT) treatments. [11] Overall, then, our experimental design suggests that filing should increase under the inducements offered by the tax credit and the social safety net provisions. Of course, different attitudes toward risk can affect these calculations.

Note that with the exception of CRT1 in which all income levels are eligible, the positive inducements applied here are intended to target lower income taxpayers. In CRT2, the tax credits apply to 50–90 percent of the income earners; in UBT the unemployment benefit safety net pays out 50 percent of average earnings. Because of this targeting, the net tax yield from the participants in all of these settings is quite small when the proposed programs are implemented. For the settings in which there are 10 participants in a group (the typical case) and the income distribution ranges from a high of 100 lab dollars to a low of 10 lab dollars, total income is 550 lab dollars; at a tax rate of 35 percent applied to the net of deduction (15 percent) income, the tax yield for full compliance is 110 lab dollars per round. By way of comparison, the per-round cost of the income tax credit CRT1 is 90 lab dollars, and the per-round cost of the low income tax credit CRT2 is 60 lab dollars; for the social safety net (unemployment benefits), there is an expected cost under full compliance and filing of 90 lab dollars. Thus, the net yield to the tax authority is generally small. Nevertheless, if the objective is to increase filing, the programs that we investigate must be judged against this target.

4. Results and discussion

A total of 218 subjects participated in 14 sessions. Table 4 reports the means and

Table 5. Frequency of form obtained, form filed, and reported full, by treatment.

Treatment	Form obtained	Form filed	Reported full|form filed
No inducement	0.676 (0.468)	0.652 (0.477)	0.827 (0.378)
Income tax credit	0.673 (0.470)	0.640 (0.480)	0.822 (0.383)
Low income tax credit	0.734 (0.442)	0.704 (0.457)	0.867 (0.339)
Unemployment benefits	0.659 (0.474)	0.636 (0.481)	0.832 (0.374)
Unemployment benefits + low income tax credit	0.855 (0.352)	0.813 (0.391)	0.791 (0.407)

Notes: The top number in each cell reports the proportion of subjects obtaining a form (form obtained), filing a filing form (form filed), or reporting full income conditional upon filing a form (reported full\|form filed); the number in parentheses reports the standard deviation.

standard deviations of the main variables of interest. The experimental design entails the following treatment variables: the cost of obtaining the tax form (*form cost*), the *audit probability*, the opportunity to claim a general income tax credit (*income tax credit*), the opportunity to claim a low income tax credit (*low income tax credit*), and the availability of unemployment benefits (*unemployment benefits*). Observed outcomes include the subject's earned income (*income*), whether the subject purchased the tax form (*form bought*), whether the subject filed the form (*form filed*), and whether the subject reported all income (*report full*). Subjects averaged 29.8 years of *age* (the range being ages 18–71), and 41 percent were male (*sex*, equal to 1 if male and 0 if female). The typical participant earned nearly 50 lab dollars per round, obtained a tax form about 70 percent of the time, and filed the form nearly 68 percent of the time. Among the subjects who filed a form, 83 percent complied by reporting their full tax obligation. In only 4 instances

(out of 4324 observations) did a subject not complete the various tasks within the 75 s limit.

Table 5 summarizes subject/taxpayer behavior by treatment. A substantial number of participants file a tax return even when there is no obvious incentive.[12] In the "no inducement treatment" settings, 65 percent of the participants file a return.

This behavior is consistent with similar observations in the field, in which many individuals disclose income even though the probability of detection via an audit is extremely low. Indeed, as argued by Webley et al. (1991) and others, observed levels of tax compliance can only be explained by extreme forms of risk aversion (Bernasconi, 1998) or by the presence of different "types" of individuals in the population (Bloomquist, 2011) some of whom are innately compliant and others who are innately non-compliant. Since the participants in these experiments know with certainty they will not be audited if they do not file a tax return, we appear to be observing a base level of innate compliance. However, in any experiment the key observation is the differential behavior that accompanies the introduction of treatment effects; that is, what is of most interest is not so much the *level* of filing compliance but the *change* in this behavior, as reflected in the responses of the subjects to changes in the incentives to file (Alm, 1991).

Turning to the treatment effects, we first review the frequencies of obtaining and filing a form reported in the second and third columns. The aggregate numbers suggest that the general tax credit does not alter the decision to obtain and file forms, but a more targeted low income tax credit does lead to significantly higher rates of obtaining and filing a form. The frequencies of obtaining and filing forms in the general income tax credit (CRT1) treatment are statistically equivalent to those observed in the NIT treatment (0.676 versus 0.673; 0.652 versus 0.640), while the frequencies are significantly higher in the low income tax credit (CRT2) treatment (0.734 versus 0.673; 0.704 versus 0.652). The numbers also indicate that the presence of unemployment benefits (UBT) alone does little to influence the decision to obtain and file a form (0.659 versus 0.676; 0.636 versus 0.652), but that unemployment benefits with the low income tax credit provide a strong inducement to obtain and file a form. In cases that entailed both unemployment benefits and the low income tax credit, the frequency of obtaining and filing a form was significantly greater than those observed in the no inducement treatment (0.855 versus 0.676; 0.813 versus 0.652).

Beyond the issue of inducing filing via social programs, the question might arise whether the programs have an impact on the subsequent compliance decision of reporting the full tax obligation. The fourth column of Table 5 provides the frequency of full reporting decisions for those subjects who filed a form. The numbers suggest the presence of the social programs have little influence on under-reporting of tax obligations, with frequencies of full reporting statistically equivalent across treatments. Note, however, that full reporting was 4 percentage points higher in the low income tax credit treatment than in the NIT setting (0.867 versus 0.827).

To test the strength of these initial impressions from the aggregate data, we conduct conditional analyses at the individual level that estimate treatment effects while holding other factors constant. We estimate the following empirical model:

$$T_{i,t}^* = \beta_1 + b_2 P_{i,t} + \beta_3 I_{i,t} + \beta_4 p_{i,t} + \beta_5\, CR_i + \beta_6\, UB_i + \beta_7\, LUB_{i,t-2} + \beta_8 D_i + \psi_t + u_i + \varepsilon_{i,t},$$

with

$$T_{i,t} = \begin{vmatrix} 1 & \text{if } T_{i,t}^* > 0 \\ 0 & \text{if } T_{i,t}^* \le 0 \end{vmatrix},$$

where $T_{i,t}^*$ Ti,t* denotes the latent variable for subject i 's filing decision in period t ; $T_{i,t}$ is the observed indicator function, equal to 1 if $T_{i,t}^* > 0$ Ti,t*>0 and equal to 0 if $T_{i,t}^* \le 0$ Ti,t*≤0; $P_{i,t}$ is the price that subject i must pay to obtain a tax form in period t; I_i is subject i's earned income in period t; $p_{i,t}$ is the audit probability for subject i in period t; CR_i and UB_i are indicator variables that signify the presence of a tax credit and unemployment benefits for subject i; $LUB_{i,t-2}$ is an indicator variable that signifies that subject i received unemployment benefits two periods prior; D_i is a vector of demographic variables (e.g., subject age and sex); ψ_t is a set of $T-1$ dummies that capture potential non-linear period effects; u_i are random effects that control for unobservable individual characteristics [13]; $\varepsilon_{i,t}$ is the contemporaneous additive error term; β_k is the coefficient for variable k. We also include interaction variables between income and both tax credits for subject i in time t.

Table 6. Estimation results.

Independent variable	Form obtained	Form filed	Reported full|form filed
Form cost	−0.379** (0.1505)	–	–
Income	0.007*** (0.0013)	0.007*** (0.0013)	0.011*** (0.0022)
Audit probability	0.437 (0.6370)	0.057 (0.6282)	1.341 (1.0101)
Income tax credit	0.858*** (0.3082)	0.664** (0.3110)	1.338*** (0.5026)
Low income tax credit	1.394*** (0.2779)	1.513*** (0.2650)	0.171 (0.3437)
Income × income tax credit	−0.009*** (0.0026)	−0.009*** (0.0026)	−0.018*** (0.0054)
Income × low income tax credit	−0.021*** (0.0024)	−0.021*** (0.0023)	−0.007** (0.0031)
Unemployment benefits (−1 if yes)	−0.044 (0.2238)	−0.001 (0.2244)	−0.914*** (0.3109)
Unemployment benefits received (lagged 2 periods)	0.366*** (0.1046)	0.322*** (0.1013)	0.564*** (0.1562)
Age	0.024*** (0.0085)	0.026*** (0.0084)	0.035*** (0.0115)
Sex (−1 if male)	−0.765*** (0.1996)	−0.828*** (0.2050)	−0.597** (0.2878)
χ² (p-value)	158.87 (0.0000)	147.58 (0.0000)	96.75 (0.0000)
Number of Observations	3980	3980	2652

Notes: The dependent variables are form obtained (−1 if yes), form filed (−1 if yes), and reported full|form filed (−1 if yes). Marginal effects are reported with standard errors in parentheses unless otherwise noted. *, **, and *** indicate significance at the 10, 5, and 1 percent levels, respectively.

From this specification, we estimate three models: obtaining a tax form ($T_{i,t} = 1$ if the form is bought and 0 otherwise); filing a tax form ($T_{i,t} = 1$ if the form is filed and 0 otherwise); reporting full tax obligation ($T_{i,t} = 1$ if all income is reported and 0 otherwise). [14] For each, we estimate the basic specification using both a linear probability model and a non-linear probit specification, in each case controlling for subject heterogeneity and time period effects. [15] We limit the presentation in Table 6 to the marginal effects derived from the probit estimates.

The conditional estimates in Table 6 clarify our initial impressions. The presence of tax credits and unemployment benefits clearly encourages individual tax filing. Regarding tax credits, the conditional results show that both the regular (CRT1) and the more targeted (CTR2) tax credits significantly increase the likelihood of obtaining and filing a tax form, with the low income tax credit providing a larger marginal effect. This finding suggests that a targeted program is more effective in encouraging behavior. Estimated marginal effects on the interaction terms indicate that this positive impact diminishes with income, a result consistent with expectations because the credit is targeted to lower income participants and any impact from the credit will be negatively correlated with income.

Estimates concerning the influence of unemployment benefits provide mixed results. The mere presence of an unemployment benefits program does not appear to increase filing. However, an indirect effect exists from increased filing by individuals receiving benefits in the past, as shown by the estimated marginal effect on the unemployment benefits received variable. This variable indicates whether a current income earner was unemployed and received unemployment benefits in the previous two periods, and its estimate suggest that the likelihood of filing is affected by the previous receipt of unemployment benefits ($p < 0.01$).

We again examine the secondary question of whether social programs might influence the decision to under-report tax obligations. Estimates generally mimic those reported for the filing decisions, though several differences arise. The presence of unemployment benefits has a significant negative effect on the likelihood of fully reporting income and tax obligations. Also, the low income tax credit has no significant effect on the reporting decision.

Confidence in the internal validity of the data, and therefore in the results, is provided by the correspondence of remaining estimates with a priori expectations established in theoretical studies, as well as in other experimental studies.[16] Our results show that the likelihood of obtaining a tax form is negatively related to the cost of getting the form and that the level of earned income is positively related to participation.[17] Our estimates also show that changes in audit probability have no significant effect on participation, a result that is likely due to the small range of audit probabilities used in our experimental design. Finally, the estimated marginal effects of the age and sex variables are consistent with past work in this area.

An interesting extension is to consider how the social programs affect net tax receipts. In Table 7, we first consider tax receipts independent of program cost by reviewing the mean individual tax payment as a percent of total tax obligation (with

Table 7. Tax payments by treatment.

Treatment	Percent of tax obligation paid	Mean tax payment	Tax receipts per person
No inducement	0.926 (0.198)	14.75 (9.09)	9.95 (10.20)
Income tax credit	0.915 (0.226)	4.60 (13.99)	3.13 (11.52)
Low income tax credit	0.934 (0.208)	3.26 (16.39)	2.47 (14.10)
Unemployment benefits	0.873 (0.319)	14.94 (8.82)	9.81 (10.12)
Unemployment benefits + low income tax credit	0.840 (0.348)	0.74 (21.71)	1.18 (19.94)

Notes: Means are reported with standard deviations in parentheses.

standard deviations in parentheses). The numbers show little difference between the two tax credit treatments and the No Inducement treatment, but reveal more under-reporting in the unemployment benefits treatments. Incorporating program cost, Table 7 also reports the mean net tax payments (with standard deviations) made by filers, which show considerable variation across treatments. The NIT and UBT settings yield the highest payments, while the CRT setting offers much lower payments. The combination of unemployment benefits and income tax credits yields the lowest mean tax payment.

5. Conclusions

The presence of non-filers has important policy implications. Fiscally induced allocation of effort leads to inefficiencies, and tax evasion via non-filing by "ghosts" also leads to misallocation through differentials from relative payoffs between official (taxed) and unofficial (untaxed) activity. Non-filing generates inequities due to differential treatment of those who file and those who do not. There is, finally and obviously, a revenue loss from non-filing.

Our experimental results suggest several promising strategies for encouraging greater filing rates. In particular, our results indicate that an can encourage participation, but that targeting the credit to low income earners offers a stronger inducement to file. The provision of a social safety net via unemployment benefits also has a positive, albeit indirect, impact on participation. These results should help in the design of other programs designed to address non-filing. Further, our results suggest that reminding potential filers of the existence of credits and social safety nets should be a part of these programs. More broadly, our results indicate that strategies to improve compliance must be based on more than the "stick" of increased enforcement but should include the "carrot" of positive inducements for filing.

Of course, one may assert that the programs that we examine are simply methods that "pay" individuals to file tax returns. Even so, our results indicate that such positive incentives clearly do matter. The usual enforcement paradigm focuses on the use of negative incentives, or avoiding a penalty by filing. Here the focus is on positive incentives, or rewards for filing. Our results indicate that these positive incentives affect individual choices, and also that they may yield social benefits beyond tax compliance. The same cannot be said for negative incentives.

A perhaps more fundamental issue is whether tax compliance experiments that utilize student subjects can generalize beyond the laboratory. This issue relates to the

"external validity" of tax compliance experiments, and indeed of laboratory experiments more broadly. Levitt and List (2007) have argued persuasively that the "parallelism" (Smith, 1982 and Plott, 1987) between the laboratory setting and the naturally occurring world that must be present to generalize beyond the laboratory may not in fact be present in many cases. They argue specifically that there is often an excessive amount of "pro-social" behavior exhibited by human subjects in laboratory experiments compared to the level of such behavior observed in the real-world, and they identify several factors that they believe promote greater pro-social behavior in a laboratory setting.

Even so, the issue of external validity cannot be answered in general, but must be examined in specific cases. Indeed, in other work (Alm et al., 2011) we show that the experimental responses of student subjects are very similar to the experimental responses of non-student subjects, in identical experiments; that is, students do not behave differently than non-students in identical experiments. We also compare the experimental responses of student subjects to non-student responses in the naturally occurring world using Internal Revenue Service (IRS) data, and we again find that there is no significant difference in behavior, in terms of mean compliance levels, the frequency distribution of compliance rates, and the econometrically estimated behavioral responses. Overall, the results of Alm et al. (2011) indicate that the observed behaviors of students and non-students, whether in the laboratory or in the naturally occurring world, are qualitatively and quantitatively similar.

In short, we recognize that laboratory experiments must be used with some care. Even so, we believe that experimental results can provide a useful guide to real-world policy design. In particular, the ability to induce greater amounts of filing via positive inducements presents governments with a largely unutilized policy tool in the endless quest to deal with non-compliance.

Appendix A. Experiment instructions, income tax credit treatment

Experiment overview

• You will be participating in a market simulation that lasts several decision "rounds".
• In each round, you first play an earnings game and then face a tax reporting decision.
• Each round is completely independent from the others, which means your decisions in one round in no way affects the outcome of any other round.
• In the tax reporting decision, you choose whether or not to fill out and file a tax form.

If you file a tax form:

• On the tax form, you decide how much to claim in deductions and how much to claim in tax credits. These two amounts determine your Final taxes paid. If "Final taxes paid" is a negative number, then this reflects a tax refund.
• You will know the exact amount of your actual deduction and credit (this is displayed on the left side of the tax reporting screen). You can choose to claim any amount between 0 and 30 for the credit and any amount between 0 and your income earned for the deduction.
• You have a 30 percent chance of being audited. Audits are determined completely at random and do not depend on your decisions or the decisions of others.
• If you are not audited, or if you are audited but do not owe additional taxes, your earnings for the round are your income earned minus the final taxes paid.
• If you are audited, your earnings for the round are adjusted as follows:
◦ If the amount of deductions you claimed was *more* than what you were allowed, then you must pay taxes on the difference (unpaid taxes);
◦ If the amount of credits you claimed was *more* than what you were allowed, then you must pay back the difference (unpaid taxes);
◦ In addition, you pay a penalty equal to 150 percent multiplied by the amount of unpaid taxes (from deductions and credits).
◦ If you claimed *less* in deductions and/or credits than you were allowed, you will not be refunded the difference. In this sense, the audit can never help you.

If you do *not* file a tax form:

• You will not be audited.
• If you are not audited, your earnings for the round equal your income earned.

Appendix B. Experiment instructions, unemployment benefits treatment

Experiment overview

• You will be participating in a market simulation that lasts several decision "rounds".
• In each round, you first play an earnings game and then face a tax reporting decision.

• Each round is completely independent from the others, which means your decisions in one round in no way affects the outcome of any other round.
• In the tax reporting decision, you choose whether or not to fill out and file a tax form.

If you file a tax form:

• On the tax form, you decide how much to income to report. This determines your final taxes paid. If "final taxes paid" is a negative number, then this reflects a tax refund.
• You have a 30 percent chance of being audited. Audits are determined completely at random and do not depend on your decisions or the decisions of others.
• If you are not audited, or if you are audited but do not owe additional taxes, your earnings for the round are your income earned minus the final taxes paid.
• If you are audited, your earnings for the round are adjusted as follows:
∘ If the amount of income you reported was less than what you earned, then you must pay back the difference (unpaid taxes);
∘ In addition, you pay a penalty equal to 150 percent multiplied by the amount of unpaid taxes.

If you do not file a tax form:

• You will not be audited.
• If you are not audited, your earnings for the round equal your income earned.
During the experiment you may be unemployed:
• This will be determined by a random draw. If you become unemployed this will last for two periods and you will not be able to earn income. You have a 20 percent chance of being unemployed each period.
• If you have reported income in the previous two periods you will receive unemployment benefits. This is an income equal to the average of your reported income for the two previous periods and you will receive this income for the two periods when you are unemployed.

References

Allingham, M.G., Sandmo, A., 1972. Income tax evasion: a theoretical analysis. Journal of Public Economics 1 (3–4), 323–338.

Alm, J., 1991. On the experimental analysis of taxpayer reporting. The Accounting Review 66 (3), 577–593.

Alm, J., 2012. Measuring, explaining, and controlling tax evasion: lessons from theory, experiments, and field studies. International Tax and Public Finance 19 (1), 54–77.

Alm, J., Bahl, R., Murray, M.N., 1991. Tax base erosion in developing countries. Economic Development and Cultural Change 39 (4), 849–872.

Alm, J., Bloomquist, K., McKee, M., 2011. On the external validity of tax compliance experiments. In: Presented at the 2011 IRS-TPC Tax Research Conference, Washington, DC.
Alm, J., Jackson, B.R., McKee, M., 1992a. Deterrence and beyond: towards a kinder, gentler IRS. In: Slemrod, J. (Ed.), Why People Pay Taxes. University of Michigan Press, Ann Arbor, MI, pp. 311–329.

Alm, J., Jackson, B.R., McKee, M., 1993. Fiscal exchange, collective decision institutions, and tax compliance. Journal of Economic Behavior and Organization 22 (4), 285–303.

Alm, J., McClelland, G.H., Schulze, W.D., 1992b. Why do people pay taxes? Journal of Public Economics 48 (1), 21–38.

Alm, J., McKee, M., Beck, W., 1990. Amazing grace: tax amnesties and compliance. National Tax Journal 63 (1), 23–38.

Andreoni, J., Erard, B., Feinstein, J., 1998. Tax compliance. The Journal of Economic Literature 36 (2), 818–860.

Becker, G.S., 1968. Crime and punishment – an economic approach. The Journal of Political Economy 76 (2), 169–217.

Becker, W., Buchner, H.-J., Sleeking, S., 1987. The impact of public transfer expenditures on tax evasion: an experimental approach. Journal of Public Economics 34 (2), 243–252.

Bernasconi, M., 1998. Tax evasion and orders of risk aversion. Journal of Public Economics 67 (2), 123–134.

Bloomquist, K.M., 2011. Tax compliance as an evolutionary coordination game: an agent-based approach. Public Finance Review 39 (1), 25–49.

Cadsby, C.B., Maynes, E., Trivedi, V.U., 2006. Tax compliance and obedience to authority at home and in the lab: a new experimental approach. Experimental Economics 9 (4), 343–359.

Cherry, T., Shogren, J.F., 2008. Self-interest, sympathy, and the origin of endowments. Economics Letters 101 (1), 69–72.

Cowell, F., 1990. Cheating the Government: The Economics of Evasion. The MIT Press, Cambridge, MA.

Crain, S.E., Nourzad, F., 1993. An empirical analysis of factors that distinguish those who evade on their tax return from those who do not file a return. Public Finance/ Finances Publiques 49 (Suppl.), 106–118.

Cummings, R., Martinez-Vazquez, J., McKee, M., Torgler, B., 2009. Tax morale affects tax compliance: evidence from surveys and an artefactual field experiment. Journal of Economic Behavior and Organization 70 (3), 447–457.

Erard, B., Ho, C.-C., 2001. Searching for ghosts: who are the non-filers and how much tax do they owe? Journal of Public Economics 81 (1), 25–50.

Gerxhani, K., Schram, A., 2006. Tax evasion and the source of income. Journal of Economic Psychology 27 (3), 402–422.

Graeber, M.J., Nichols, B.L., Sparrow, D., 1992. Characteristics of delinquent returns. U.S. Department of the Treasury, Internal Revenue Service, The IRS Research Bulletin, Publication 1500, pp. 38–46.

Greiner, B., 2004. The online recruitment system ORSEE 2.0 – a guide for the organization of experiments in economics. Working Paper Series in Economics 10, Department of Economics, University of Cologne, Cologne, Germany.

Internal Revenue Service, 1996. Federal Tax Compliance Research: Individual Income Tax Gap Estimates for 1985, 1988 and 1992. IRS Publication 1415 (Rev. 4-96), Washington, DC.

Kopczuk, W., Pop-Eleches, C., 2007. Electronic filing, tax preparers and participation in the earned income tax credit. Journal of Public Economics 91 (7–8), 1351–1367.

Levitt, S.D., List, J.A., 2007. What do laboratory experiments measuring social preferences reveal about the real world? The Journal of Economic Perspectives 21 (2), 153–174.

Plott, C.R., 1987. Dimensions of parallelism: some policy applications of experimental methods. In: Roth, A.E. (Ed.), Laboratory Experimentation in Economics: Six Points of View. Cambridge University Press, New York, NY, pp. 193–229.

Scholz, J.K., 1994. The earned income tax credit: participation, compliance, and antipoverty effectiveness. National Tax Journal 47 (1), 63–87.

Slemrod, J., Yitzhaki, S., 2002. Tax avoidance, evasion, and administration. In: Auerbach, A.J., Feldstein, M. (Eds.), Handbook of Public Economics. Elsevier, Amsterdam/London/New York, pp. 1423–1470.

Smith, V.L., 1982. Microeconomic systems as an experimental science. The American Economic Review 72 (5), 923–955.

Torgler, B., 2007. Tax Compliance and Tax Morale: A Theoretical and Empirical Analysis. Edward Elgar Publishing, Cheltenham, UK.
Webley, P., Robben, H., Elffers, H., Hessing, D., 1991. Tax Evasion: An Experimental Approach. Cambridge Univer

Wooldridge, J.M., 2002. Econometric Analysis of Cross Section and Panel Data. The MIT Press, Cambridge, MA.