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Abstract

A significant amount of non-compliance associated with the personal income tax is due to the taxpayers who are not "in the system," not having filed a tax return in the recent past or perhaps ever. We use experimental laboratory methods to examine two types of positive incentives for filing tax returns: tax credits and social safety net benefits, both of which are conditional on tax filing. Our 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 then decide whether to file a tax return and, conditional upon filing, 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 must then pay the owed taxes plus a fine based on the unpaid taxes; non-filers are not subject to an audit. Inducements for filing are introduced in several alternative treatments. In one treatment we introduce a social safety net (e.g., unemployment replacement income) that is conditional on past filing behavior. In a second treatment we introduce tax credits that are available either to low income participants or to all income levels, but again only to those who file a tax return. Our results suggest that a tax credit increases filing but only if the credit is targeted to low income earners. The provision of a social safety net via unemployment benefits also has a positive, albeit indirect, impact on participation.

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I. Introduction

A significant amount of non-compliance associated with the individual income tax in most countries around the world is due to the taxpayers who are not "in the system," not having filed a tax return in the recent past or perhaps ever. Indeed, the compliance process in most countries is almost always tied to the existence of a tax return, which makes non-filing especially attractive because it avoids the financial burden of paying taxes and it simultaneously reduces 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 low to middle income citizens who are often "under the radar" of the tax authority because they receive income not subject to third-party 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] A problem facing policy makers is encouraging these taxpayers to join the system. The payoff to the tax agency from such inclusion may be very high, and evidence suggests that once taxpayers initially file a tax return they continue to do so in the future. Because non-filing also introduces inefficiencies in resource allocation and inequities between those who pay taxes and similarly situated individuals who successfully cheat, finding ways to encourage filing also has payoffs to society. Encouraging filing can be accomplished either through negative incentives (e.g., detection and punishment) or through positive incentives (e.g., the receipt of

[1] Another class of non-filers is represented by those earning income through illegal activities who choose not to report such activities. The policy instruments that we investigate here are not designed to address this class of behavior. However, it is interesting to note that failing to pay tax on income from illegal activities can compound the penalties and increase the probability of detection since an additional crime is being committed. In some countries like Canada, the tax agency is precluded from reporting illegal activity to other law enforcement agencies, and it is not uncommon for marijuana growers in Canada to file tax returns on the income from this activity.

[2] Income taxes not reported and paid by non-filers in the U.S. were estimated at $27 billion for tax year 2001, out of a total "tax gap" of $345 billion. See http://www.irs.gov/pub/irs-news/tax_gap_figures.pdf . In many other countries, especially developing countries, non-filing is even more significant.

payments that are conditional upon filing a return). In this paper, we examine the effectiveness of positive inducements in the individual tax filing decision.

There are several potential avenues in the tax system for encouraging participation via tax filing. One prominent class of policies encouraging tax participation is the receipt of direct benefits under various income transfer programs and public sector pensions for which all citizens are eligible. Included here are programs broadly classified as social insurance programs. The receipt of benefits associated with these programs can be used to encourage tax filing since being "in the system" may be a condition for eligibility.

The use of tax credits to affect participation is a more targeted approach. These programs often provide targeted tax credits conditional upon filing, which thereby create incentives for individuals to participate in the tax system; at the same time the costs of participation must be minimized, so that such programs must pass the test of being administratively simple for the taxpayer. The 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 lion's share of benefits going to families with children. The EITC is somewhat complicated, and this feature has probably led to lower participation.[3] A significant percentage of EITC participants would be outside the tax system in the absence of the program. However, audit procedures under the program impose an additional cost (both economic and psychological) on participants, which may have reduced participation among this class of taxpayers; indeed, there has been targeted

[3] This may be a factor leading to the estimates of Erard and Ho (2001) that 29 percent of the non-filers may have been entitled to get money back were they to file. They also argue that EITC-eligible individuals are over-represented among non-filers.

auditing of those filing for the credit. The child care expense tax credit is another example of a targeted tax credit that encourages filing.[4]

The difficulty in assessing the effects of such policies is the 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. Indeed, studies of non-filing using field data are not numerous. While compliance behavior is difficult to observe in the field, non-filing is even more hidden. Crain and Nourzad (1993) compared the characteristics of those who evade while filing versus those who choose simply to not file. The Internal Revenue Service (IRS) (Graecher, Nichols, and Sparrow, 1992) has also conducted studies of delinquent returns to ascertain factors specific to non-filers. In the most detailed and comprehensive study of non-filing, Erard and Ho (2001) use IRS information to estimate the factors that affect non-filing.[5]

As with all studies based on field data, however, these studies suffer from not having direct measures of noncompliance (e.g., the use of reported income, not unreported income), from being forced to contend with various econometric issues (e.g., the endogeneity of audit selection arising from budgets for audit activities), and from the inability to control for all

[4] There also exist other policies that may increase compliance and participation. Anxiety reduction for potential taxpayers as they approach the tax agency (i.e. emphasizing a "kinder, gentler, tax agency") may increase compliance and participation. Research has shown that taxpayers respond to positive inducements to comply (Alm, Jackson, and McKee, 1992), but there may be consequences of such positive inducements on initially compliant taxpayers. Tax amnesties can be an effective means of allowing taxpayers to "wipe the slate clean" if they have evaded taxes in the past (Alm, McKee, and Beck, 1990). Similarly, perceptions of fairness have a significant effect on individual decisions (Cherry and Shogren, 2008). Also, some current tax policies often permit individuals to claim losses from some classes of earnings (e.g., capital gains, self-employment income) against income taxes imposed on other wage and salary income, but only if the individual files a tax return. While these policies are typically understood as focusing on higher income taxpayers, the programs also affect middle and low income taxpayers and those working outside the purview of the tax authority (e.g., individuals with part-time self-employment or with cash only businesses). Provided an individual has taxable income from wages and salaries, he or she can benefit from the use of offsets. Indeed, the presence of loss offsets may encourage individuals to undertake entrepreneurial activities involving some risk of incurring losses. "Social norms" may also affect tax compliance. There has been work in this area, and the results suggest that such motives can have a positive effect on compliance. Even so, there has been little literature on filing itself. See, for example, Cummings, Martinez-Vazquez, McKee, and Torgler (2009).

[5] See Alm, Bahl, and Murray (1991) for analysis of non-filing in Jamaica.

variables that might affect taxpayer reporting 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 such changes as do occur are often confounded with other effects such as changes in macroeconomic conditions.[6]

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, Buchner, and Sleeking, 1987; Webley et al. 1991; Alm, Jackson, and McKee, 1992; Alm, Jackson, and McKee, 1993; Gerxhani and Schram, 2006; Cummings, Martinez-Vazquez, McKee, and Torgler, 2009), there are no experimental analyses of filing inducements, in which subjects have the option to file or not to file a tax return.

Accordingly, our research here is directed at assessing the effects on filing of reinforcing recognition of the the social insurance aspect of the fiscal system and of providing tax credits, either of which is received only if the taxpayer files a return. To examine these issues, we introduce in a controlled laboratory setting various filing inducements, including social safety nets and tax credits.

Our 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, must decide whether to file and, conditional upon filing, how much of this income to report to a tax agency. Taxes are paid on reported income only.

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[6] Some quasi-natural experiments have been conducted. For example, the introduction of the EITC has provided an opportunity to observe changes in the characteristics of filers. Scholz (1994) uses 1990 Survey of Income and Program Participation (SIPP) data, and finds that the participation rate for the EITC is between 80 and 86 percent Most recently one could study the effects of the Bush Administration "stimulus package" tax rebate checks on the filing behavior of citizens, although those data are not yet available.

Unreported income may be discovered via a random audit, and the participant must then pay the owed taxes plus a fine based on the unpaid taxes. However, only individuals who file a return and are "in the system" may be selected for audit; non-filers are not subject to an audit.[7] Positive inducements for filing are introduced in several alternative treatments. In one treatment we introduce a social safety net (e.g., unemployment replacement income) that is conditional upon past filing behavior. In a second treatment we introduce tax credits that are available either to low income participants or to all income levels, but again only to those who file a tax return. We find that an untargeted tax credit does not influence participation, but targeting the credit to low income earners increases filing. We also find that the provision of a social safety net via unemployment benefits has a positive, albeit indirect, impact on participation.

In the next section we discuss the theory underlying the filing (and reporting) decision. We then present our experimental design, followed by the experimental results. We conclude in the final section.

II. 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, where if caught a fine is assessed (Allingham and Sandmo, 1972; Yitzhaki, 1974). 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,

[7] The audit probability for non-filers is set at zero in these experiments. In the field the rate is not zero but is effectively very close to zero. In the US the IRS may conduct audits of non-filers based on tips, "lifestyle audits" in which visible expenditures are a flag for an audit, or through passive income sources such as deposit interest. Since the frequency is very low, we elected to implement a zero audit probability in the lab setting.

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 and productive 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 this fear of detection and punishment.[8]

As noted earlier, this decision has been extensively investigated using field and lab data.[9] For those who file, the traditional recipe of increased audits and/or increased penalties is the recommended policy for increasing compliance, subject to the taxpayers' awareness of the enforcement effort increase (Alm, Jackson, and McKee, 2009).

Of perhaps more interest is the issue of the *filing* decision. To the extent that non-filers persons are not "in the system" and so face little or no risk of being selected for audit, the traditional policy response of increased enforcement efforts is not effective.[10] Indeed, the traditional Allingham and Sandmo (1972) and Yitzhaki (1974) analyses 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. Evasion while reporting raises the specter of an audit since the tax return is "in the system"; a return that has not been filed may be exposed to a much lower risk of audit. However, if the individual who has not filed a return is detected as having not filed, there may be additional penalties; see Erard and Ho (2001) for a description. The tradeoff is a lower probability of

[8] See Cowell (1990), Andreoni, Erard, and Feinstein (1998), Alm (1999), and Slemrod and Yitzhaki (2002) for comprehensive surveys and discussions of this literature.
[9] Again, see Cowell (1990), Andreoni, Erard, and Feinstein (1998), Alm (1999), and Slemrod and Yitzhaki (2002).
[10] Most audit schemes are based on factors that are reported on tax returns and that past audit results indicate are associated with large amounts of unreported income (e.g., the Internal Revenue Service use of a "DIF" score). Individuals who do not file a return are obviously not at risk of audit from such audit schemes.

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) expand the traditional model to include both of these *filing* and *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. The framework is an extension of the typical "gamble" model of evasion, but incorporates the more realistic setting that reflects the true decision setting of the taxpayer. 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 (where the benefits may be uncertain), both of which may be conditional on prior tax filings.[11] Both the tax credit and the expected value of the social safety net represent positive inducements to file.

To see how these may enter the individual's calculus, we modify the Erard and Ho (2000) framework. In the absence of tax credits or income support programs, an individual who decides to file a tax return and report income has expected utility equal to:

(1) Filing: $(1-p)\,U(Y-tX-c) + p\,U(Y-tX-(1+f)t(Y-X)-c)$,

where p is the probability that a tax return is audited, Y is the individual's "true" income, X is the amount of reported income, t is the tax rate on declared income, f is the penalty rate on

[11] Further factors that may affect filing decisions include social norms. There has been work in this area, and the results suggest that such motives can have a positive effect on compliance. Even so, there has been little literature on filing itself. See Gerhanxi and Schram (2006) and Cummings, Martinez-Vazquez, McKee, and Torgler (2007).

undeclared taxes, c is the burden of preparing and filing a tax return, and $U(\ )$ is the utility function. Expected utility in equation (1) equals the expected utility if the individual files a tax return at cost c, declares income X, pays taxes tX, and is not audited, or $(1-p)\ U(Y-tX-c)$, plus the expected utility if the individual is caught and is forced to pay all taxes on undeclared income, or $p\ U(Y-tX-(1+f)t(Y-X)-c)$. The individual chooses the amount of reported income to maximize expected utility.

We modify this equation to introduce a tax credit or an income support program:

(1)' Filing – Tax Credit: $(1-p)\ U(Y-tX+CR-c) + p\ U(Y-tX+CR-(1+f)t(Y-X)-c)$,

(1)'' Filing – Income Support: $(1-p)\ U(Y-tX+E(IS)-c) + p\ U(Y-tX+E(IS)-(1+f)t(Y-X)-c)$.

In equation (1)', the individual receives a tax credit whose (fixed) value is CR and whose receipt is conditional upon filing (and whose magnitude may vary with income). In equation (1)'', an individual who has been previously unemployed and who files a tax return is eligible for income support IS whose expected value is $E(IS)$, where $E(\ )$ is the expectation operator; as with the tax credit, receipt of income support is conditional upon filing. In both cases, the individual must still choose the amount of reported income X to maximize expected utility. An individual who chooses not to file a tax return (and so who declares no income) has expected utility equal to:

(2) Non-filing: $(1-q)\ U(Y) + q\ U(Y-(1+f)tY-c)$.

Here q is the probability (possibly equal to zero) that an individual who has not filed a return is apprehended by an audit. The individual compares the value of expected utility from filing and reporting the optimal amount of income in the relevant case of equations (1), (1)', or (1)'', with expected utility if the individual decides not to file a tax return.

It is clear 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 *t*, the fine rate *f*) have more complicated effects. It is the positive inducements for filing from tax credits and income support programs that our experimental design investigates.

III. Experimental Design

The experimental design captures the essential features of the voluntary income reporting and tax assessment system used in many countries.[12] 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 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.[13] 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 effectively no chance of detection. 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

[12] The full set of experimental instructions is available upon request.

[13] It may be argued that current audit practice in many countries also implements endogenous audits, since a taxpayer either elicits an audit or not depending on his or her "score" in an audit rule. However, whether a taxpayer is actually audited depends *both* on the score *and* on the audit budget of the tax authority. Since the taxpayer cannot know this latter item with certainty, there remains a random component to the audit process. See Alm and McKee (2004) for an experimental examination of this type of endogenous audit selection rule.

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.[14]

Participants are recruited from the pool of undergraduate students and staff at a major public university.[15] Upon arrival at the laboratory, the 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 seven to ten persons depending on the total number of participants in the session) and there are always two groups in a session to implement anonymity. The instructions are provided via a series of screen images. There is no interaction or communication between the participants; also, there is virtually no interaction between the participants and the person running the experiment. All decisions are made privately, and participants are not allowed to communicate with one another during the session. Also, the 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 form signed to receive payment at the end of the session. Subjects do not sign consent forms to further increase their anonymity. Participants are told, via the instructions, that payments will be made in private at the end of the session and that all responses are anonymous.

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[14] These experiments are designed to inform policy makers, and so must satisfy Smith's (1982) precept of "parallelism". Parallelism is satisfied when the experimental setting captures the essential elements of the decision problem faced in the naturally occurring setting. It is neither necessary nor desirable that the experimental setting implement all of the complexity of the naturally occurring setting (Plott, 1987). As implemented, our experimental design follows the elements of much of the earlier research (e.g., Becker, Buchner, and Sleeking, 1987; Alm, Jackson, and McKee, 1992; 1993), but incorporates additional features to improve parallelism with taxpayers' decision making in the naturally occurring world. Participants earn income by performing a task (rather than receiving an endowment), they must choose how much income to report, and they face an audit process similar to that in the naturally occurring setting. Importantly, participants must choose whether or not to file a return. The experiments utilize tax language in the instructions and computer interface. While the stakes are small, the decision is also simplified, implying that the ratio of decision costs and rewards parallels the naturally occurring setting (Smith and Walker, 1993).

[15] Recruiting was conducted using the Online Recruiting System for Experimental Economics (ORSEE) developed by Greiner (2004). The participant database was built using announcements sent via email to students and staff. Participants were contacted via email, and were permitted to participate in only one tax experiment, although other experimental projects were ongoing at the time and participants may have participated in other types of experiments.

Taken together, these experimental procedures implement the properties of a double blind design. The lack of subject-to-subject interaction implements a single blind setting.[16] The lack of subject-to-experimenter interaction, the strictly imposed subject anonymity through the computer interface, and the private payment mechanism to subjects implement a double blind design between the subject and experimenter.

Participants are not told the exact duration of the experimental session, which is predetermined to last for 20 real rounds (together with 3 practice rounds). Sessions take on average 70 minutes to complete. Participant earnings range from $14 to $38, depending upon task earnings, filing and reporting behavior, and audit experience.[17]

The earnings task requires the participants to sort the digits 1 through 9 into the correct ascending order from a randomized order presented in a 3 by 3 matrix (see Appendix A, Figure A-1). Participants do this by pointing the computer mouse and "clicking" on the numbers in the correct sequence. A 3 by 3 matrix with the digits in random order first appears on the right side of each subject's computer screen; as the numbers are "clicked", they then appear in a 3 by 3 matrix on the left side of the screen. A counter on the screen shows the elapsed time from when the first number is "clicked" and also when all nine numbers have been ordered, and the participant clicks the "Continue" button to transmit this time to the server. Actual income is determined by the relative speed of performance, with the fastest performer receiving the highest income and the slowest performer receiving the lowest income. Once all participants have completed the income task, they are informed via the computer of their income for the round and

[16] As discussed later, subject anonymity is also implemented via our use of a computerized draw from a "bingo cage". Use of a computerized bingo cage means that subjects do not know who, if anyone, is audited and that subjects also do not know the outcome of any audit. In some previous experimental work, a mechanical random draw device has been used. However, to make this draw credible to subjects, the results of the draw must be announced, and doing so means that the subjects learn if someone is audited, which violates the precepts of a double blind design.

[17] The exchange rate for sessions with staff participants was set to yield payments commensurate with their outside earnings, an adjustment that involved halving the exchange rate between lab dollars and U.S. dollars.

presented with a screen that provides the details of the policy in effect, where they are informed of the tax rate, the audit probability, and the penalty rate on discovered evasion (see Appendix A, Figure A-2).

For the credit treatments, the participants are informed of the level of the tax credit they are eligible to receive and that receipt of this amount is conditional upon filing a tax return (and upon the level of income that is reported). For the income support (or unemployment benefit) treatments, the 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. The unemployment benefits are determined as follows. The number of filing periods for eligibility is stated in the instructions, and the benefit is a stated percentage of the average of the incomes reported on filing during the periods required for eligibility.

The tax form is not provided at this point. This simulates the need for the participant to collect information needed to file a return. Participants may choose to get a form or not, where there may be a cost for the form (see Appendix A, Figure A-3). 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 reflects the typical feature of tax systems that individuals who do not file a return and so who are not "in the system" effectively face a zero chance of audit.[18] If the participant chooses to get the form, then the cost, if there is one, is deducted from the participant's income for the round. Even if the participant obtains the form, he or she may still choose to not file by selecting the "Not File" button. Since the tax filing season is limited in the field, there is a time limit

[18] The participants are also not subject to a future audit on a report from a current round; that is, audits only review the current report. In future work, we will impose a small but non-zero audit probability here to reflect the possibility that the individual may be detected through other transactions that may be subject to matching paperwork (e.g., bank interest earnings).

imposed (75 seconds), 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. See Appendix A, Figure A-4 for an example of the tax return.

At the end of the session, the participants complete a short questionnaire by reporting their age, gender, and whether they prepare and file their own taxes. If they respond "No" to this last question, we assume that their parents are responsible for tax preparation, given that some of the participants are college sophomores, juniors, and seniors.[19]

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 blue and white balls in total, 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.[20] 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 a new screen that provides the earnings and audit outcome summary for the round.

[19] Since these experiments utilize tax language, it is important to control for innate, or homegrown, values regarding tax compliance. Based on previous experimental work, we have determined that the most immediate measure of these values would be obtained from individual experience in filing personal income taxes.

[20] This approach is similar to that used in some previous evasion studies (Cummings, Martinez-Vazquez, and McKee, 2006), but differs from Alm, Jackson, and McKee (1993) where a mechanical bingo cage was used. A computerized draw has the advantage of increasing the degree of anonymity among the subjects since it is impossible for a subject to observe the audit experience of other subjects. This anonymity is more difficult to implement if a mechanical device (such as a bingo cage or urn) is used.

Our objective is to examine the effects of positive inducements to file a tax return. The basic programs are outlined in Table 1. Our focus is on the use of tax credits and on the income protection offered through unemployment benefits. To establish a baseline, we conduct sessions in which these inducements are absent, but the other features of the tax filing regime are incorporated. The no-inducement treatments (denoted "NI") are described in Table 2. 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 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 2, the audit rates for NI are 0.4 for 8 rounds, 0.3 for 8 rounds, and 0.4 for the final 4 rounds. Participants are instructed that the rate may change during the course of the session, but they are not told the specific pattern. In all cases, the on-screen bingo cage shows the audit rate as the number of blue balls of the 10 white and blue balls in the cage.

Table 1 – General Treatment Design for Investigation of Inducements to File

Treatment	**Sample Parameters**	
No Positive Inducement	Cost of Tax Form and Probability of Audit	
Refundable Tax Credit	Conditional on Low Income	Available to All Income Levels
Income (Employment) Risk	Support: Moderate Percentage of Previous Income	Support: High Percentage of Previous Income

In all sessions the subjects must obtain the tax form. The cost of the form ranges from zero to two lab dollars, and this information is presented at the time the choice of whether to obtain the form is being made. The tax form cost in the experiment represents the overall costs of filing incurred, in addition to the cognitive cost of simply completing the form.

Table 2 – No Inducement (NI) Conditions

Treatment	Tax Rate	Audit Probabilities	Penalty Rate	Deduction	Income Range	Form Cost
NI	35%	0.4, 0.3, 0.4	150%	15%	10 to 100	2, 1, 0

Notes: The "Income Range" is 10 ("Low") to 100 ("High"), with increments of 10 and with1 person per level.

The first set of 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.[21] The basic tax credit settings are shown in Table 3 as CT1 and CT2, where "CT" denotes "Credit Treatment" and where the key difference between these treatments is the targeting of the income tax credit to lower income earners in CT2.

Table 3 – Tax Credit Treatment (CT) Settings

Treatment	Income Range	Form Cost	Audit Probability	Credit Equation
CT1	10 – 100	2, 1, 0	0.3, 0.4, 0.3	CR = 20 – 0.2*I (Income Tax Credit)
CT2	10 – 100	2, 1, 0	0.3, 0.4, 0.3	CR = 30 – 0.6*I (Low Income Tax Credit)

Notes: The "Income Range" is 10 ("Low") to 100 ("High"), with increments of 10 and with1 person per level. The credit equation reports the intercept (e.g., the base credit) and the reduction in the credit as income increases. For example, if CR = 20 – 0.2*I ("Income Tax Credit"), then 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 at 100 lab dollars, which is the maximum income level possible. In the "Low Income Tax Credit" setting, 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 inducement investigated here is the presence of an income support program that pays benefits in the event of the individual becoming unemployed. Payment of benefits is

[21] Alm, Deskins, and McKee (2009) investigate the filing behavior of individuals earning income not subject to the type of matching paperwork usually associated with formal sector earnings.

conditional on the previous filing history of the individual. Specifically, benefit payouts are computed as a stated percentage of average income filed in previous periods. The parameters in effect for this series of sessions are shown in Table 4, where "UT" denotes "Unemployment Treatment". Audit probabilities and cost of the tax form are set at levels in the baseline and credit treatments so that we can focus on policy parameters specific to the unemployment benefits program and on the effect of risk of becoming unemployed. Thus, in Table 4 we introduce as treatments the percentage of the income that will be replaced by the unemployment benefits; in both cases, the number of required filing periods is 2.

During the periods of unemployment, the participant does not have the opportunity to earn income (the income earning task screen is suppressed). Instead, subjects are presented a screen informing them that they are unemployed and that this is round *x* of unemployment period of duration *y*; see Appendix A, Figure A-5. The unemployment benefits in our setting are taxable. Thus, the participants are presented a screen informing them of the unemployment benefits (if any) that they will receive in the current round and of the opportunity to obtain a tax form or not. 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.

Table 4 – Unemployment Benefits Treatment (UT) Settings

Treatment	Form Cost	Audit Probability	Probability of Unemployment	Percentage Benefits	Filing Periods Required
UT1	2, 1, 0	0.3, 0.4, 0.3	0.4 and 0.2	0.5	2
UT2	2, 1, 0	0.3, 0.4, 0.3	0.4	0.6	2

With the exception of CT1, the positive inducements applied here are intended to target lower income taxpayers. In CT2 ("Low Income Tax Credit"), the tax credits apply to 50 to 90 percent of the income earners; in both UT1 and UT2, the unemployment benefit safety net pays out 50 to 60 percent of average earnings. (In "Income Tax Credit" CT1, all income levels are eligible for a credit.) 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 of CT1 is 90 lab dollars, and the per-round cost of the Low Income Tax Credit of CT2 is 60 lab dollars; for the social safety net (unemployment insurance), 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, the objective is to increase filing, and it is this behavior that we analyze here.

Our hypothesis is that filing will increase under the inducements offered by the tax credit and the social safety net provisions. The next section presents and discusses our results.

IV. Results and Discussion

A total of 338 subjects participated in 24 sessions, each lasting between 18 and 20 rounds, yielding 4,424 observations. Table 5 reports the means and standard deviations of the variables used in the analysis. 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

credit (*Income Tax Credit*), the opportunity to claim a low income 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*), and whether the subject filed the form (*Form Filed*). Subjects averaged 29.8 years of *Age* (the range being ages 18 to 71), and 41 percent were male (*Sex*). The typical participant earned nearly 50 lab dollars per round, bought a tax form about 70 percent of the time, and filed the form nearly 68 percent of the time.

Table 5 – Descriptive Statistics

Variable	Mean	Standard Deviation
Form Cost (lab$)	0.566	0.779
Audit Probability	0.349	0.056
Income Tax Credit (Yes=1)	0.503	0.500
Low Income Tax Credit (Yes=1)	0.298	0.458
Unemployment Benefits (Yes=1)	0.353	0.478
Form Bought (Yes=1)	0.704	0.457
Form Filed (Yes=1)	0.675	0.468
Income (lab$)	49.846	31.458
Age (Years)	29.807	13.572
Sex (Male=1)	0.410	0.492

Table 6 summarizes subject/taxpayer behavior by treatment. These aggregate numbers suggest three main results. First, the presence of a general tax credit does not alter the rate that subjects obtain and file forms. The frequencies of obtaining and filing forms are essentially the same across the No Inducement and the general Income Tax Credit treatments (or 0.676 versus 0.673 and 0.652 versus 0.640).[22] Second, a targeted low income credit increases the frequencies

[22] Note that the frequency of filing is quite high, even in the No Inducement settings in which the incentive to file a return is not present. This high filing rate may be due in part to such factors as "obedience to authority" (Cadsby, Maynes, and Trivedi, 2006) or as "pro-social behavior" (Levitt and List, 2006). Indeed, it is common in many experimental studies for subjects to behave in more cooperative and less individualistic ways than predicted by the theory; again, see Cadsby, Maynes, and Trivedi (2006) and Levitt and List (2006) for numerous examples. Even so,

of obtaining and filing forms. Rates of each are over five percentage points greater in the Low Income Tax Credit treatments than in the No Inducement baseline. Third, the presence of unemployment benefits provides an even larger positive impact on filing behavior. The frequencies of obtaining and filing forms are nearly 18 percentage points greater than the rates observed without any inducement, and are over 10 percentage points greater than the case of a low income tax credit.

Table 6 – Frequency of Form Bought and Form Filed by Treatment Variable

Treatment	Frequency of Form Bought	Frequency of Form Filed
No Inducement	0.676 (0.468)	0.652 (0.477)
Income Tax Credit	0.673 (0.470)	0.640 (0.480)
Low Income Tax Credit	0.734 (0.442)	0.704 (0.457)
Unemployment Benefits	0.855 (0.352)	0.813 (0.391)

Notes: The top number in each cell reports the percentage of subjects obtaining/filing form, and the number in parentheses reports the standard deviation.

Some of these results warrant discussion. First, a substantial number of participants file a tax return even when there is clearly no incentive. In the "No Inducement" setting 65% of the participants file a return. This is consistent with similar observations in the field, in which many individuals disclose income although the probability of detection via an audit is extremely low and tax compliance can only be explained by either extreme forms of risk aversion (Bernasconi, 1998) or the presence of different "types" of individuals in the population (Bloomquist, 2009) some of whom are innately compliant and others innately non-compliant. Since the participants

as argued by Alm (1991), what is of more interest in the experimental analysis of compliance is not so much the *levels* of filing compliance but the *changes* in this behavior, as reflected in the responses of the subjects to changes in the incentives to file.

in these experiments know with certainty they will not be audited if they do not file a tax return, we must be observing a base level of innate compliance. In any experiment the key observation is the differential behavior that accompanies the introduction of treatment effects. In Table 6 we observe that the filing frequency increases under the targeted tax credit and the presence of social safety nets but not the general tax credit.

To confirm these initial impressions from the aggregate data, we conduct a conditional analysis at the individual level that estimates treatment effects while holding other factors constant. We estimate the following empirical model:

$$(3) \qquad T_{i,t} = \beta_1 + \beta_2 P_{i,t} + \beta_3 I_{i,t} + \beta_4 p(A)_{i,t} + \beta_5 C_i + \beta_6 UB_i + \beta_7 LUB_{i,t-2} + \beta_8 D_i + \psi_t + u_i + \varepsilon_{i,t},$$

where the dependent variable $T_{i,t}$ denotes subject *i*'s decision to obtain or to file a tax form in period *t*; $P_{i,t}$ is the price subject *i* must pay to obtain a tax form in period *t*; I_i is subject *i*'s earned income in period *t*; $p(A)_{i,t}$ is the audit probability for subject *i* in period t; C_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[23]; 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[24]; $\varepsilon_{i,t}$ is the contemporaneous additive error term; and β_k is the coefficient for variable *k*. We also include interaction variables between income and credit for subject *i* in time *t*.

From this specification, we estimate a model of obtaining a tax form ($T_{i,t}$ = 1 if the form is bought and 0 otherwise) and a model of filing a tax form ($T_{i,t}$ = 1 if the form is filed and 0

[23] Note that the introduction of a lagged variable reduces the number of observations in the analysis.
[24] Given the between subject design of key treatment variables, we must utilize a random effects specification to control for subject heterogeneity.

otherwise). For each, we estimate equation (3) using both a linear probability model and a probit specification, in each case controlling for subject heterogeneity and time period effects.[25] These estimates are presented in Table 7.

The conditional estimates in Table 7 corroborate our initial impressions discussed above. The presence of tax credits and social safety nets (here, unemployment benefits) clearly encourages individual tax filing. Tax credits are effective only when targeted to low income individuals. As suggested by the aggregate data, the general Income Tax Credit does not significantly influence the fraction of individuals deciding to obtain or file a tax form. However, when the credit is targeted to low income earners, the Low Income Tax Credit has a highly significant effect on increasing compliance ($p<0.01$). As in many other instances, targeted programs yield superior results. Estimated coefficients 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.

The mere presence of an unemployment benefits program does not appear to increase filing. However, an indirect effect arises from increased filing by individuals receiving benefits in the past. Our estimation results indicate that the presence of unemployment benefits has no significant impact on compliance behavior but that, after receiving benefits, individuals are significantly more likely to obtain and file tax forms ($p<0.01$). We apply a two period lag to the receipt of unemployment benefits since this is the duration of unemployment. After two periods, the individual is earning income (employed) and we are interested in whether the likelihood of filing from such income is affected by the unemployment benefits program (safety net).

[25] A random effects specification is also available in a logit model, and we have estimated a logit specification. Our results are similar across both probit and logit procedures. Likelihood ratio tests indicate the need to control for subject heterogeneity in all models ($p<0.01$), while tests indicate the significance of period effects are marginal.

Table 7 – Estimation Results

	Linear Model		Probit Model	
Independent Variable	**Form Filed**	**Form Bought**	**Form Filed**	**Form Bought**
Constant	0.554*** (0.0848)	0 .723*** (0.0881)	-0.005 (0.4047)	0.706* (0.4379)
Form Cost	--	-0.074*** (0.0314)	--	-0.319** (0.1521)
Income	0.001*** (0.0002)	0.001*** (0.0002)	0.006*** (0.0013)	0.007*** (0.0013)
Audit Probability	0.018 (0.1361)	0.109 (0.1333)	0.084 (0.6278)	0.470 (0.6369)
Income Tax Credit	0.002 (0.0020)	0.001 (0.0019)	0.008 (0.0101)	0.003 (0.0107)
Low Income Tax Credit	0.189*** (0.0006)	0.167*** (0.0684)	1.229*** (0.3365)	1.205*** (0.3644)
Income x Income Tax Credit	-0.002*** (0.0006)	-0.001** (0.0006)	-0.006** (0.0027)	-0.005** (0.0027)
Income x Low Income Tax Credit	-0.002*** (0.0007)	-0.002*** (0.0007)	-0.012*** (0.0034)	-0.014*** (0.0035)
Unemployment Benefits (=1 if Yes)	-0.034 (0.0449)	-0.056 (0.0441)	-0.137 (0.2164)	-0.223 (0.2203)
Unemployment Benefits Received (Lagged 2 Periods)	0.077*** (0.0211)	0.084*** (0.0207)	0.334*** (0.1011)	0.381*** (0.1043)
Age	0.003** (0.0017)	0.002 (0.0017)	0.023*** (0.0084)	0.020*** (0.0086)
Sex	-0.176*** (0.0432)	-0.171*** (0.0413)	-0.851*** (0.2069)	-0.807*** (0.2036)
χ^2 (p-value)	146.42 (0.0000)	156.80 (0.0000)	142.57 (0.0000)	150.00 (0.0000)
N	3980	3980	3980	3980

Notes: The dependent variable is Form Filed (=1 if Yes) and Form Bought (=1 if Yes). Standard errors are reported in parentheses unless otherwise noted. *, **, and *** indicate significance at the 10, 5, and 1 percent levels, respectively.

Confidence in the internal validity of the data, and therefore the results, is provided by the correspondence of remaining estimates with a priori expectations established in the literature.

Our results show that the likelihood of purchasing a tax form is negatively related to the price of the form, and that the level of earned income is positively related to participation.[26] Recalling that the probability of an audit is predicted to matter, our estimates show that changes in the audit probability have no significant effect on participation.[27] Finally, the coefficients on the age and sex variables are consistent with much of the past work in this area.

V. Conclusions

Encouraging filing has important policy implications. Fiscally induced allocation of effort leads to inefficiencies arising from resource misallocation, and tax evasion via the non-filing by ghosts also leads to misallocation through the relative payoffs between official (taxed) and unofficial (untaxed) activity. Non-filing also 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 indicate several promising strategies for encouraging greater filing rates. In particular, our aggregate and econometric results indicate that an untargeted tax credit does not influence participation. However, if the credit is targeted to low income earners, it does have the potential to increase filing. 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.

[26] We do not include the price of the tax form in the filing models, under the presumption the filing decision is made after the purchase decision. Given that the decisions may not be independent, we also estimate the filing models that include the price of the form, and find no significant difference in our results.
[27] This is likely due to the small range of audit probabilities used in our experimental design.

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Appendix A – Screen Images

Figure A-1: Income Earning Task Screen

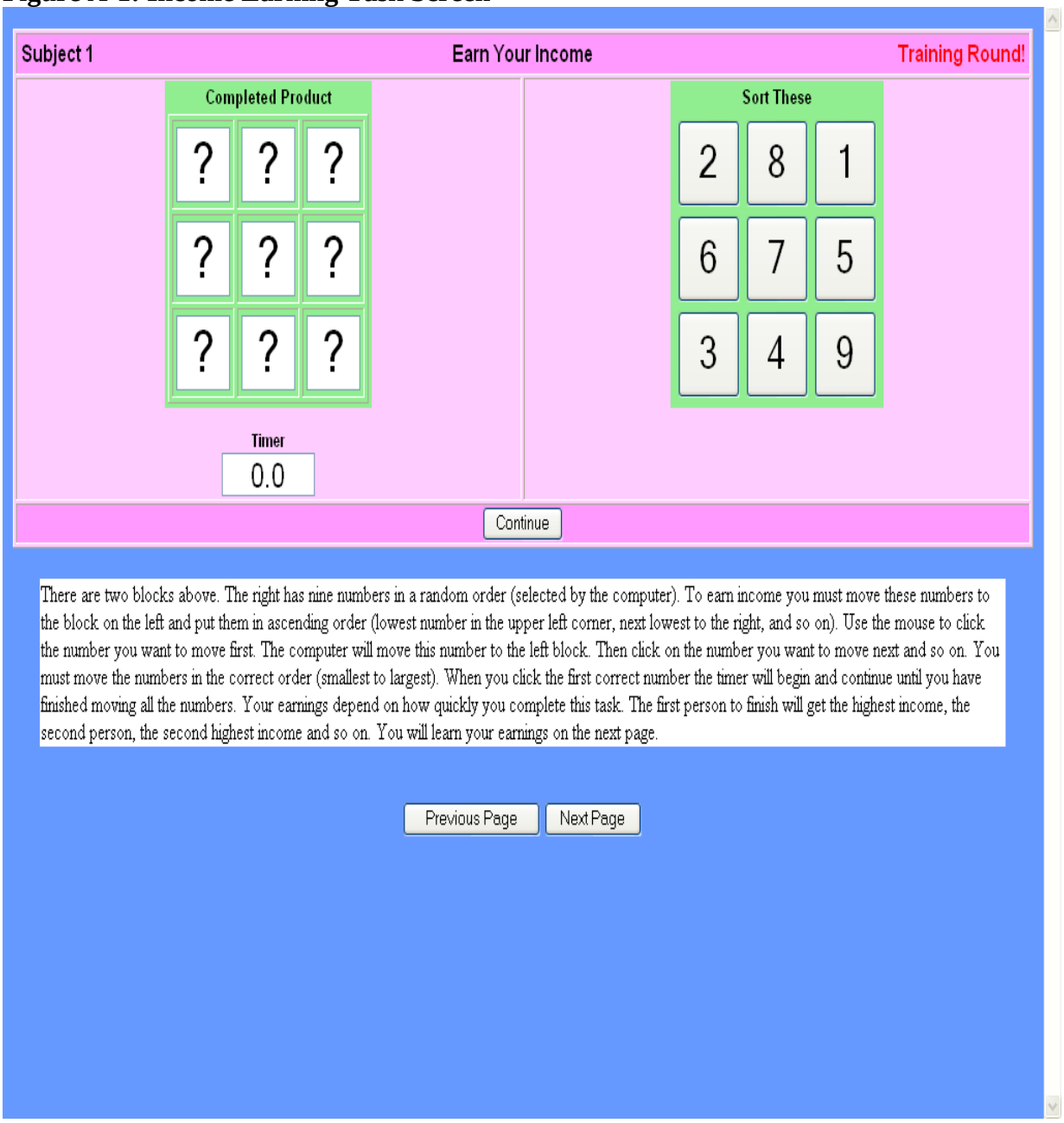


Figure A-2: Income and Tax Policy Screen

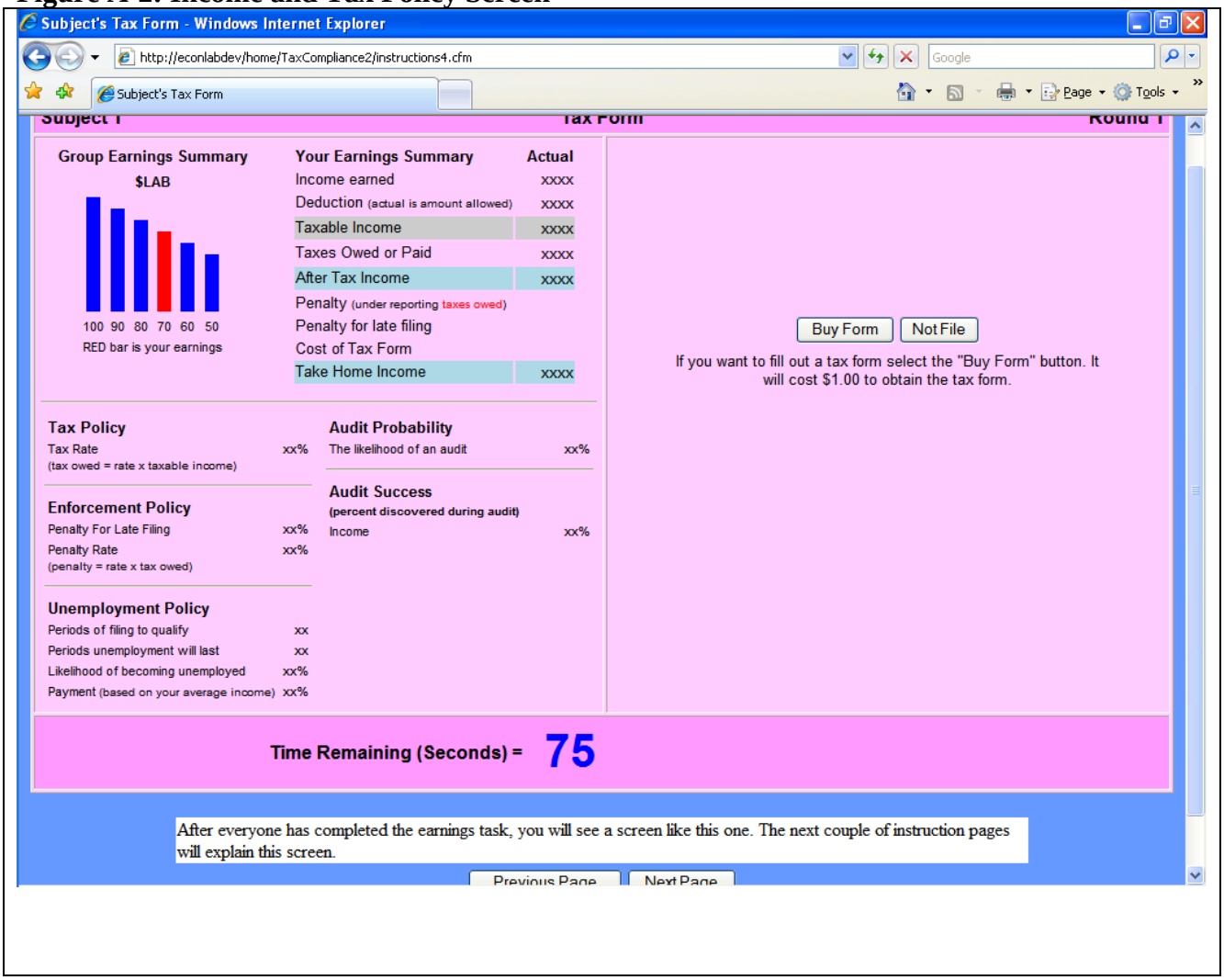
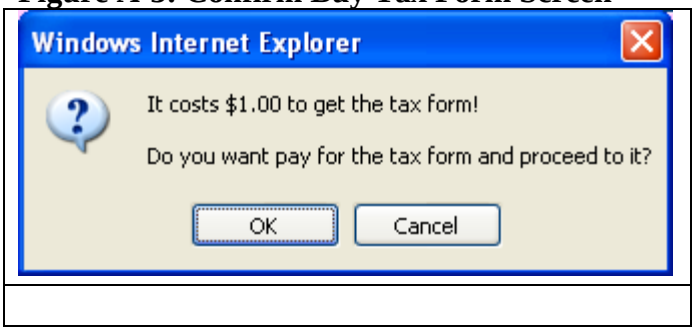


Figure A-3: Confirm Buy Tax Form Screen



Note that the cost is an experimental parameter.

Figure A-4: Tax Form Screen – Deductions and No Tax Credit

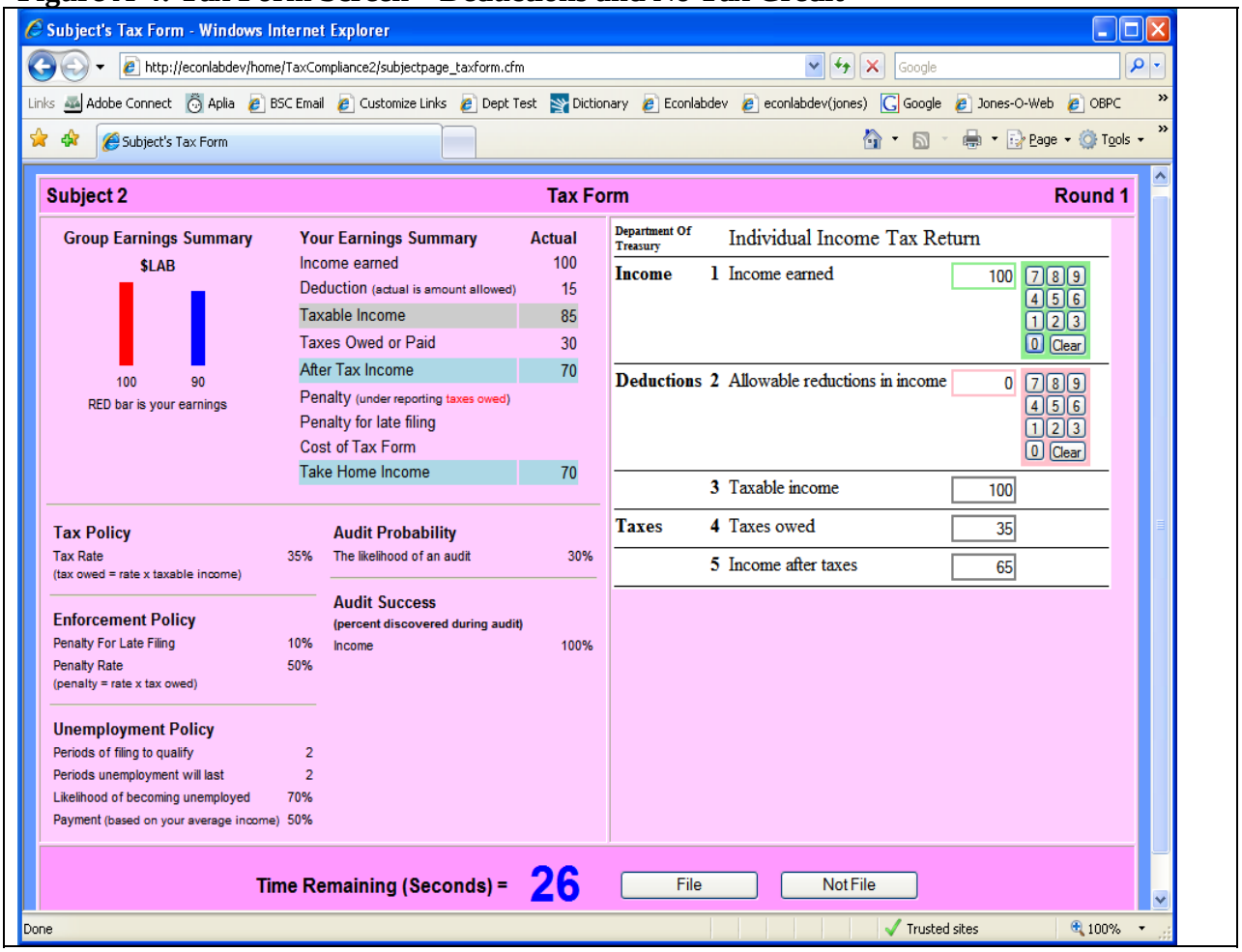


Figure A-5: Screen if Individual is Unemployed