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When You Know Your Neighbor Pays Taxes: Information, Peer Effects, and Tax Compliance*

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Abstract

In this paper, we argue that individuals are affected in their compliance behavior by the behavior of their “neighbors”, or those about whom they may have information, whom they may know, or with whom they may interact on a regular basis. Individuals seem more likely to file and to report their taxes when they believe that other individuals are also filing and reporting their taxes; conversely, when individuals believe that others are cheating on their taxes, they may well become cheaters themselves. We use experimental methods to test the role of such information about peer effects on compliance behavior. In one setting, we inform individuals about the frequency that their neighbors submit a tax return. In a second setting, we inform them about the number of their neighbors who are audited, together with the penalties that they pay. In both cases, we examine the impact of information on filing behavior and also on subsequent reporting behavior. We find that providing information on whether one’s neighbors are filing returns and/or reporting income has a statistically significant and economically large impact on individual filing and reporting decisions. However, this “neighbor” information does not always improve compliance, depending on the exact content of the information.

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1. Introduction

It is increasingly recognized that an individual considers multiple factors in the decision to pay – or not to pay – the legally due tax obligations. One set of factors is of course the consequence of a failure to pay one's taxes. Indeed, the standard economic model of taxpayer behavior concludes that the probability of detection and the penalty on detected evasion are the crucial factors in the individual compliance decision. However, there is much recent research that demonstrates the role of many factors beyond enforcement and that expands the basic model of compliance in a search for other factors that may better explain why people pay taxes.¹ In this paper we argue that the compliance puzzle can be explained, at least in part, by recognizing the often neglected role of information about peer effects in individual behavior.

There is in fact a long tradition in psychology, as well as in economics and sociology, that emphasizes the many impacts of peer effects on behavior. In the psychology literature, this research has examined factors such as “group norms” (Sherif, 1936), the “bandwagon effect” (Asch, 1951, 1952), “conformity” and “social influence” (Kelman, 1958), “obedience to authority” (Milgram, 1974), and the like. In economics and sociology, this work has emphasized the role of “social dilemmas” (Dawes, 1980), “social networks” (Wasserman and Faust, 1994), “tax morale” (Frey, 1997; Orviska and Hudson, 2002), “social capital” (Putnam, 2000), “moral identity” (Akerlof and Kranton, 2000), and especially “social norms” (Elster, 1989, 1999; Young, 1998); this work is also consistent with notions such as fairness, trust, appeals to patriotism or conscience, or feelings of altruism, morality, and alienation. Regardless of the specific terms that are used, all of this research concludes that the behavior of one's peers can

¹ For example, see Kirchler (2007), Torgler (2007), and Alm (2012) for comprehensive surveys and discussions of the tax evasion literature, emphasizing economic and psychological aspects, as well as individual and group dimensions, of decisions.

exert a strong influence on one's own behavior, at least if there is information on these peer effects.

We argue that individuals are affected in their compliance behavior by the behavior of their “neighbors”, or those about whom they may have information, whom they may know, or with whom they may interact on a regular basis. Individuals seem more likely to file and to report their taxes when they believe that other individuals are also filing and reporting their taxes; conversely, when individuals believe that others are cheating on their taxes, they may well become cheaters themselves. We also argue that understanding compliance behavior requires understanding how information about one's neighbors affects two aspects of individual behavior: the *reporting* decision and also the logically prior *filing* decision. Most analyses of tax compliance focus entirely on the reporting decision, assuming implicitly that the individual has already chosen to file a return. In contrast, we examine both behavioral dimensions.

We use experimental methods to test the impact of information about peer effects on compliance behavior. To examine these responses, we introduce in a controlled laboratory setting various policies that inform individuals about the compliance behavior of others, whom we refer to as their “neighbors”. In one setting, we inform individuals about the frequency that their neighbors submit a tax return. In a second setting, we inform them about the number of their neighbors who are audited, together with the penalties that they pay. In both cases, we examine the impact of information on filing behavior and also on subsequent reporting behavior. We find that providing information on whether one's neighbors are filing returns and/or reporting income has a statistically significant and economically large impact on individual filing and reporting decisions. However, this “neighbor” information does not always improve compliance, depending on the exact content of the information.

2. Theoretical framework: Information, peer effects and the filing and reporting decisions

2.1. The standard portfolio model of individual reporting behavior

Most theoretical analyses of the individual's compliance decision begin with the economics-of-crime model of Becker (1968), first applied to tax compliance by Allingham and Sandmo (1972). Here a rational individual is viewed as maximizing the expected utility of the tax evasion gamble, weighing the benefits of successful under-reporting against the risky prospect of detection and punishment; implicitly, this approach assumes that the individual has already chosen to file a return, and so it focuses on the *reporting* decision. The individual pays taxes because he or she is afraid of getting caught and penalized if some income goes unreported. This “portfolio” 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.²

More precisely, an individual who has already decided to file a tax return and report income must choose R , or the amount of income to report (net of any allowable tax deductions), so as to maximize expected utility:

$$\text{Reporting Decision: } EU = (1-p)U(I-tR-C) + pU(I-tR-(1+f)t(I-R)-C), \quad (1)$$

where E is the expectation operator, $U(\cdot)$ is the utility function, I is the individual's “true” taxable income, t is the tax rate on reported income, p is the audit rate (or the probability that a filed tax return is selected for audit), f is the penalty rate on unreported taxes, and C is the financial (and

² See Cowell (1990), Andreoni, Erard, and Feinstein (1998), Alm (1999), Slemrod and Yitzhaki (2002), Sandmo (2005), and Alm (2012) for comprehensive surveys and discussions of much of this literature.

time) burden of preparing and filing a tax return. Optimization of equation (1) with respect to R proceeds using standard methods, and comparative statics results are easily derived.

2.2. Extension to filing behavior

However, the individual's *filing* decision is also of interest, and has seldom been examined. Indeed, the traditional portfolio analysis of the *reporting* decision does not fully capture the individual's *filing* decision because submitting a tax return with underreported liabilities is inherently different from failing to submit a return at all. To address the filing decision, the individual must compare the expected utility from filing with optimal income reporting to the expected utility from non-filing. The risk of detection for non-filing is likely to be significantly different from the risk for a return that is "in the system", and is termed an "enforcement rate"; similarly, the "enforcement penalty" for failing to file a return is likely to be different (and higher) than the penalty imposed on detected underreporting.³

To address both filing and reporting decisions, we retain but modify the reporting framework developed in Erard and Ho (2001), Alm et al. (2010), and Kleven et al. (2011). Here, an individual who decides to file a tax return and report income R has expected utility equal to equation (1). An individual who chooses not to file a tax return (and so who reports no income) has expected utility equal to:

$$\text{Filing Decision:} \quad EU = (1-p^*)U(I) + p^*U(I - (1+f^*)tI). \quad (2)$$

³ In practice, it is very difficult for the tax authorities to detect non-filers because non-filers are simply unknown to the authorities. For a filer, the authorities typically base an audit on information provided by the filer on the tax return. For a non-filer the authorities have no comparable information: the authorities have little, often no, information about them. Now the actual enforcement rate for non-filers in the field may not strictly be zero. However, there is substantial evidence that the detection rate is effectively very close to zero. For example, in the U.S. the Internal Revenue Service (IRS) may conduct audits of non-filers based on tips, on "lifestyle audits" in which visible expenditures are a flag for an audit, or through passive income sources such as deposit interest. However, the frequency of non-filing enforcement is very low (Erard and Ho, 2001). In other countries, the frequency is essentially zero (Alm, Bahl, and Murray, 1991).

Here p^* is the enforcement probability that an individual with income I who has not filed a return is discovered, and f^* is the enforcement penalty imposed on detected non-filers. Note that p^* is likely to be different (and lower) than p , that f^* is likely to exceed f , and that an individual who does not file a return escapes the filing cost C . The individual thus compares the expected utility from filing and reporting the optimal R in equation (1), with expected utility from not filing in equation (2), and chooses the greater.

2.3. Extension to peer effects

As discussed by Alm (2012), this framework can be easily expanded to incorporate many other relevant considerations (e.g., alternative tax and penalty functions, public goods and other positive inducements, endogenous audit detection probabilities, third-party information, labor supply decisions, tax avoidance strategies, complexity and uncertainty, and so on). We focus here on information about peer effects.

As noted earlier, there is much evidence that recognizes the many ways in which peer effects influence individual behavior. Whether these effects work through psychology, sociology, or economics, one's own behavior is often affected by what one's peers are doing, at least if there is information on these peer effects. We focus here on one aspect of such peer effects, or social norms, while recognizing that peer effects have work through many possible channels.

Specifically, there is much evidence that individuals are influenced by the social context in which they make decisions, rather than only the financial considerations of reporting and filing. For example, there appears to be what may be termed a "social norm" of tax compliance (Elster, 1989, 1999; Young, 1998). Although difficult to define precisely, a social norm can be distinguished by the feature that it is process-oriented, unlike the outcome-orientation of

individual rationality. A social norm therefore represents a pattern of behavior that is judged in a similar way by others, and is sustained in part by social approval or disapproval. Consequently, if others behave according to some socially accepted mode of behavior, then the individual will behave appropriately; if others do not so behave, then the individual will respond in kind. The presence of a social norm is consistent with a range of conceptual frameworks from a range of disciplines, whether they rely upon bandwagon effects, conformity, social influences, obedience to authority, social capital, social networks, fairness, trust, social customs, tax morale, moral identity, appeals to patriotism or conscience, or feelings of altruism, morality, and alienation. Incorporating social norms suggests that, all else equal, an individual will comply as long as he or she believes that compliance is the social norm (however defined); conversely, if noncompliance becomes pervasive, then the social norm of compliance disappears.⁴ We argue that it is via these social norms that peer effects seem likely to work, at least when information about peers is provided.

There are numerous ways of introducing social norms in the compliance framework (Alm and Torgler, 2011). A simple way is to assume that there is a non-pecuniary psychic cost, or a feeling of guilt, that is associated with evading one's own tax liability if one is not caught, as captured by the variable γ .⁵ We posit that the greater is a society's social norm of compliance, the greater is the guilt that is felt by an individual who cheats on his or her tax liability. Note that the psychic cost arises only if one is cheating and is not caught cheating, as assumed and analyzed by

⁴ In the specific context of tax evasion, see Cowell and Gordon (1988), Gordon (1989), Myles and Naylor (1996), Kim (2003), Fortin, Lacroix, and Villeval (2007), and Traxler (2010) for examples of social interactions theory. Relatedly, Bloomquist (2011) demonstrates that social interactions can be formally analyzed in an agent-based model of taxpayer compliance, and that numerical simulations of this model generate accurate predictions of aggregate compliance behavior. See also Alm and McKee (2004), who consider social interactions via a coordination game framework.

⁵ We assume that there is no psychic benefit from paying the tax. This simplifies the analysis, and may be justified if one takes the "paying taxes is a duty" viewpoint. It is straightforward to introduce such a psychic benefit.

Gneezy and Rustichini (2000). Thus, a taxpayer who complies fully experiences no change in utility from the psychic cost or guilt of evasion.

Putting these considerations together, equations (1) and (2) are modified as follows. The reporting decision becomes based upon:

$$\text{Reporting Decision: } EU = (1-p)U(I-tR-C-\gamma) + pU(I-tR-(1+f)t(I-R)-C). \quad (1)'$$

Similarly, the expected utility from non-filing involves calculation of:

$$\text{Filing Decision: } EU = (1-p^*)U(I-\gamma) + p^*U(I-(1+f^*)tI). \quad (2)'$$

As before, the individual must first choose whether or not to file a tax return, by comparing the value of expected utility from non-filing in equation (2)' with the expected utility of filing and reporting the optimal amount of income R in equation (1)'; if the individual chooses to file, the optimal amount of R is based on the solution to equation (1)'.

In the face of these many elements, the impacts on the individual's compliance decisions of variables like the tax rate and income reflect complicated interactions of income and substitution effects, and unambiguous comparative statics results often become elusive. Other variables are our focus here. For the audit and enforcement variables (p, f, p^*, f^*) , the comparative statics results are straightforward. For example, an increase in the enforcement rate for non-filing p^* increases the likelihood of filing a tax return. Also, an increase in the audit rate for filed returns p increases the amount of reported income (conditional upon filing) but decreases the incentive to file a return for those who do not report fully. These latter results suggest one hypothesis:

Hypothesis 1: An increase in the audit rate for filers p increases the amount of reported income of an individual who files a return. However, an increase in p decreases the likelihood of filing a tax return for individuals who do not report fully.

Similarly, an increase in the cost of filing C reduces the likelihood of filing but has no impact on reported income (conditional upon filing):

Hypothesis 2: An increase in the cost of filing C decreases the likelihood filing a tax return, but has no impact on the amount of reported income of an individual who files a return.

Perhaps surprisingly, the impact of social norms on filing is not unambiguous, because γ changes the psychic cost of cheating in both the reporting and the filing equations.⁶ However, it is straightforward to demonstrate that an increase in γ increases the level of reported income (conditional upon filing). This reasoning suggests several hypotheses on the effects of information:

Hypothesis 3: An increase in the psychic cost γ has an ambiguous effect on the likelihood of filing a tax return. However, an increase in γ increases the amount of reported income of an individual who files a return.

Regardless, both the filing and the reporting decisions are clearly upon the entire array of fiscal factors $(p, f, p^*, f^*, t, I, C, \gamma)$, as well as upon demographic variables that proxy for unobserved preferences. The next section presents our experimental framework for testing these hypotheses.

3. Experimental design

3.1. General experimental features

Our experimental setting implements the fundamental elements of the voluntary reporting systems of most country's individual income tax. Participants earn income by performing a simple computerized task in which they arrange numbers in sequence. They must first choose

⁶ More precisely, recall that an individual compares expected utility in the two cases (or equation (1)' versus equation (2)'). An increase in the psychic cost lowers expected utility in both bases, by an amount that depends upon the product of the probability of non-audit and the marginal utility of income in the relevant state. In general, it is not possible to determine whether this change in expected utility is greater in one case versus the other.

whether or not to file a tax return; if they choose to file a return, they must then choose how much to self report. Taxes are paid only on reported income. If an individual is audited, then any unreported taxes are discovered, and the individual must pay all unreported taxes plus a penalty. The enforcement rate for non-filing is set at zero, to reflect the fact in most countries that an individual who does not file faces no effective 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, and the like). This 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 at the rate of 80 lab dollars to 1 U.S. dollar.⁷

Participants are recruited from the pool of undergraduate students and staff at a U.S. public university (Appalachian State University in Boone, NC) using the Online Recruiting System for Experimental Economics (ORSEE) developed by Greiner (2004). The participant database was built using announcements sent via email to all students and staff. Participants were invited to a session via email, and were permitted to participate in only one tax experiment, although other experimental projects are ongoing at the time and participants may have participated in other types of experiments. Only participants recruited specifically for a session were allowed to participate, and no participant had prior experience in this experimental setting. Methods adhere to all guidelines concerning the ethical treatment of human subjects.

Upon arrival at the laboratory, participants are assigned to a computer station with each station being situated in an isolation carrel; they are also assigned to a specific group of 5 individuals, and these groups are maintained throughout the session. The dedicated experimental

⁷ Note that in some treatments we use staff members, not student subjects. In the treatments with staff members, the conversion rate was 50 lab dollars to 1 U.S. dollar.

lab consists of 25 networked computers, a server, and software designed for this series of experiments. Basic instructions are provided via a hardcopy and also via a series of screen images; see the Appendix for representative instructions and Figures 1, 2, and 3 for representative screen images.⁸ 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 talk with one another during the session; participants also do not sign consent forms to further increase anonymity. Participants are informed 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 also told that payments will be made in private at the end of the session. Taken together, these experimental procedures effectively eliminate both subject-to-subject interaction and subject-to-experimenter interaction.

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. Individuals are informed of their earnings and those of other members of the group, without being able to identify specific individuals. Earnings range from 100 lab dollars and down in increments of 10 lab dollars.

Participants are then presented with a screen that provides the details of the treatment in effect. Here they are informed with certainty of the tax rate, the enforcement and the audit rates, and the enforcement and the penalty rates, as well as the details of the treatment policy intervention. The tax form is not yet provided, a feature that simulates the need for the participant to collect the information needed to file a return. Participants may choose to get a

⁸ We present only a subset of the instructions for the different treatments, as well as only a subset of the total of 15 different computer screens that are used in the treatments. All instructions and all computer screens are available upon request.

form or not, and there is a tax form cost C (reflective of the overall costs of tax filing). 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, which reflects 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, then 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 seconds) 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.

If the participant chooses to file, then he or she must also choose the amount to report to the tax authority for each entry on the tax form (i.e., income and deduction). For each set of entries, the computer automatically calculates the resulting tax liability. Participants are able to experiment with different reports during the time allowed for filing, and they can observe the potential changes in their reported take home income.

The process of determining who among the filers 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 then a door opens and a ball exits the bucket through this door. The color indicates whether the individual is

audited. The audit applies only to the current period declarations, not to previous (or future) periods. The computer automatically deducts taxes paid and penalties (if any are owed) from participants' accounts. 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. 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.⁹

As in the naturally occurring setting, various factors complicate the tax reporting decision in our experiments. In addition to reporting earned income, an individual can claim an allowed deduction (or a reduction in taxable income). We set the tax deduction at 15 percent of income. These deduction amounts are chosen such that the participants perceive them to be salient. We set the tax rate t at 35 percent for all sessions. The penalty rate p is also fixed for all sessions at 50 percent (e.g., the participants must pay unpaid taxes plus a penalty of 50 percent of unpaid taxes if audited), a rate that is consistent with IRS policies. The enforcement probability p^* is set at zero. The audit probability p equals either 30 percent or 40 percent, and is varied once within the session; that is, 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.¹⁰ The tax form cost C varies from 0 to 2 lab dollars. Table 1 reports the general parameters used in the various sessions.

⁹ Many earlier laboratory studies (e.g., Alm, McClelland, and Schulze, 1991; Alm, Jackson, and McKee, 1992) utilized a single draw from a mechanical bingo cage for all individuals. The use of a mechanical bingo cage introduces several problems. First, a mechanical bingo cage may leave the subjects with the impression (even if mistaken) that only a fixed number of audits can occur within a round. Second, to make the draw from a mechanical bingo cage credible to subjects, the results of the draw must be announced; doing so means that the subjects learn if someone is audited, and this violates the precepts of a double blind design.

¹⁰ These rates are higher than *reported* audit rates in the U.S. or elsewhere. However, the reported IRS audit rate (currently under one percent) is somewhat of an understatement. The IRS conducts a range of audits, and for many types of audits the *actual* rates are quite high. Also, while overall audit rates are quite low, among certain income and occupation classes they are more frequent. Finally, the IRS conducts a wide range of audit-type activities, including line matching and requests for information, and these activities are much more frequent. For example, in 2005 only 1.2 million individual returns of the 131 million individual returns filed were actually audited. However, in that year the IRS sent 3.1 million "math error notices" and received from third parties nearly 1.5 billion "information returns", which are used to verify items reported on individual income tax returns.

Our experimental setting is very contextual, in order to provide the necessary degree of “parallelism” to the naturally occurring world that is crucial for the applicability of experimental results (Smith, 1982; Plott, 1987). Our experimental interface and instructions use tax language throughout, the participants decide whether or not to file a tax return, and they disclose tax liability in the same manner as on the typical tax form (e.g., entering income and deductions on a tax form). There is a time limit on the filing of income, and the individual is automatically audited if he or she fails to file on time.

Participants are not told the exact duration of the experimental session, which is predetermined to last for 20 real rounds. Including instructions, three practice rounds, and the 20 real rounds, sessions take on average 70 minutes to complete. In all 212 subjects participated in these sessions. Earnings averaged \$18 for student subjects. Staff participants received a higher exchange rate to reflect their higher outside earnings, and average payoffs for staff were \$28. 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).

3.2. Experimental treatments

Our objective is to examine the effects of information about the compliance behavior of one’s peers on an individual’s own choices. We do this by conducting treatments sessions in which different types of information about other participants is provided.

To establish a baseline, Treatment 1 (T1) provides no information of any kind about other “neighbor” individuals. In three other treatments (T2, T3, and T4), some information is provided. In the treatments where neighbor information is provided, it is presented after the audit process. For example, in T2, after all persons have made their filing decision, the computer

informs all members of a group of the number in their group who filed taxes in the current round; this information only reports the number who submitted a tax return, not the amounts filed, and it can contain positive and negative information on compliance behavior depending on the actual filing rate. Similarly, in T3 the group is also informed of the results of the audits (if any) for the current round, which provides another positive or negative measure of tax reporting behavior of one's neighbors. In T4 both types of information are provided. Since the groups are maintained throughout the session, there is opportunity to learn the group behavior. Table 2 summarizes the experimental treatments.

3.3. Expected value calculations

An individual who is risk-neutral will make his or her choices so as to maximize the expected value of the compliance gamble. Accordingly, it is useful to calculate the expected value in the treatments; these calculations also provide support for the hypotheses from the earlier discussion.

For example, in the baseline session (T1), the expected value from filing a tax return $EV(Filing)$ equals $[(1-p)(I-tR-C) + p(I-tR-(1+f)t(I-R)-C)]$, 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 undeclared taxes, I is the individual's "true" income, R is the amount of reported income net of any allowable tax deductions, and C is the tax form cost. When $p=0.3$, $t=0.35$, $f=0.5$, $C=0$, and the allowable tax deduction is 15 percent of "true" income, then $EV(Filing)$ equals 65 for $I=100$ when the individual reports fully and honestly. In contrast, the expected value from non-filing $EV(Non-filing)$ equals $[(1-p^*)I + p^*(I-(1+f^*)tI)]$, where p^* is the enforcement rate (or the probability that an individual who has not filed a return is apprehended by an audit) and f^* is the enforcement penalty. Given parameter values (mainly $p^*=0$), the expected value from non-filing

equals 100. In general, there is no incentive for an individual to file in the baseline (T1) session, even for different levels of reported income (including 0).

Changes in the parameters affect these expected values in standard ways. For example, an increase in the cost of filing C reduces expected value for an individual who files, and so reduces the likelihood that an individual will file a tax return. Similarly, an increase in the audit rate p for filers reduces the expected value of filing for an individual who has not reported fully (while leaving unchanged the expected value of non-filing), and so reduces the likelihood that the individual will file a tax return.

The other sessions (T2-T4) are expected to affect behavior by changing the psychic cost of cheating γ . In general, an increase in γ reduces both the expected value from filing and from non-filing by equal amounts; given that $EV(Filing)$ generally remains less than $EV(Non-filing)$ (even if the difference becomes smaller when γ increases), a change in the psychic cost reduces but does not eliminate the incentive for an individual. Even so, for an individual who has chosen to file a tax return, an increase in the psychic cost increases the amount of reported income.

Overall, these expected value calculations indicate that the optimal individual strategy for a risk-neutral individual is not to file a tax return. More generally, optimal individual decisions for any linear payoff function will tend to exhibit all-or-none behavior. Only very large changes in parameter values alter this tendency toward all-or-none behavior.

4. Results

We begin by presenting aggregate laboratory results in Table 3, along with some summary statistics. Note that the student portion of the subject pool covered a broad range of years in studies and majors, and no single major exceeded 8 percent of the pool. The staff pool

was similarly diverse covering all levels of support staff, non-academic professional staff, and faculty. Overall, 43 percent of the participants were male, the average age was 27 years, and students were 72 percent of the subject pool.

Some treatment effects are immediately apparent in the aggregate statistics. Informing subjects of neighbor *filing behavior* lowers both filing and reporting rates (comparing T2 with T1); the differences in the filing and the reporting rates are statistically significant in these treatments at the 1 percent level. However, informing subjects of *audit results* (or the number of filers selected for audit and the resulting penalties) increases both filing and reporting (T3 versus T1); these differences are also significantly different. Combining both information types (T4) yields significantly lower filing and reporting rates. The simple conclusion one might draw here is that the focus of individuals is on the behavior of the enforcement agency (e.g., via audit results) rather than on their neighbors (e.g., via filing behavior).

However, these simple means do not control for other factors such as individual subject effects and interaction effects. Also, the cross-treatment comparisons reflect mainly the dummy variable (or the treatment) effect and not the contribution of the levels of the information (or the proportion that actually file and the reporting behavior of filers). Finally, as shown in our theory section, information on one's neighbors can lead to higher or lower compliance; that is, the social norm that emerges may be one in which filing (or reporting) is higher or lower than the level absent the information on neighbor behavior. Thus, it is also necessary to condition the analysis by controlling for lagged behavior. Recall that the theoretical development suggests only a convergence of behavior arising from social norms. The neighborhood may focus on a low-compliance or a high-compliance equilibrium (Alm and McKee, 2004; Bloomquist, 2011).

We address these various issues, and also test the strength of the initial impressions from the aggregate data, by estimating models that permit conditional estimations of the treatment effects at the individual level while holding other factors constant. We estimate the following empirical model:

$$Y_{i,t} = \beta_1 + \beta_2 I_{i,t} + \beta_3 W_{i,t} + \beta_4 p_{i,t} + \beta_5 C_{i,t} + \beta_6 Treatment_t + \beta_7 X_i + \psi_t + u_i + \varepsilon_{i,t}, \quad (3)$$

where the dependent variable $Y_{i,t}$ denotes subject i 's filing or reporting decision in period t ; $I_{i,t}$ is subject i 's earned income in period t ; $W_{i,t}$ is subject i 's accumulated income over previous rounds (or “wealth”) in period t ; $p_{i,t}$ is the audit probability for subject i in period t ; $C_{i,t}$ is the cost that subject i must pay to obtain a tax form in period t ; $Treatment_t$ denotes the vector of treatment variables (or the type of information that is provided about the tax filing and audit experience of one's neighbors); X_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 characteristics¹¹; $\varepsilon_{i,t}$ is the contemporaneous additive error term; and β_k is the coefficient for variable k .

From this basic specification, we estimate two models: filing a tax form *Form Filed* ($Y_{i,t} = 1$ if the form is filed, and 0 otherwise); and for individuals who file a form, their *Reporting Rate* ($Y_{i,t} = \text{Taxes Paid/Taxes Owed}$). For each, we estimate equation (3) using GLS panel methods with subject random effects. The *Form Filed* equation is estimated using a linear probability model; the *Reporting Rate* equation is estimated without restrictions (i.e., with no

¹¹ Given the between subject design of key treatment variables, we must utilize a random effects specification to control for subject heterogeneity. See Wooldridge (2002).

adjustment for censoring because the reporting value is naturally bounded at zero and one) with only those individuals who filed a return included.¹² Estimation results are presented in Table 4.

We include several explanatory variables. Aside from the control variables, we include several treatment variables. The *Neighbor Filing Information Dummy* equals 1 if neighbor filing information is revealed (i.e., the number of neighbors who filed) and 0 otherwise. Similarly, the *Audit Results Dummy* equals 1 if information on neighbor audit results (audits and penalties imposed) is provided and 0 otherwise. Since the levels of the behavior are likely important given the theoretical ambiguity concerning the overall effect of the information (the possibility of coordinating of the low or high filing/reporting equilibrium), we include lagged variables for these levels: *Lag Percent Neighbors Filed* (equal to the percent of other group members who filed a return in the previous period); and *Lag Number Neighbors Audited* (equal to the number of other group members who are audited in the previous period). We also include *Lag Own Audited Dummy* (a dummy variable equal to 1 if the individual is audited in the previous period and 0 otherwise) to capture the effect of the individual's experiences with the audit process. In the estimation of filing behavior we include a dummy to reflect whether the subject prepares his or her own tax return (*Prepare Own Taxes Dummy*) in order to control for the effect of experience in behavior.

These conditional estimates clarify many of our initial impressions, and generally support our three main hypotheses. These results show that, after controlling for the dynamic effect of neighbor behavior, the behavior of one's neighbors has a statistically significant and

¹² As noted, we estimate the *Reporting Rate* equation using only data from the participants who file a form. These estimates might still be influenced by selection bias, since the reporting decision is conditional upon the prior filing decision. We have in fact estimated a standard two-step Heckman procedure that controls for selection. However, this two-step procedure does not appear to provide robust estimates because identification arises from the nonlinearities associated with the normality assumption. We are grateful to an anonymous referee for helping us to clarify our thinking on this issue.

economically large impact on filing and reporting behavior, as suggested by *Hypothesis 3*. For the *Form Filed* decision, the coefficient on *Lag Percent Neighbors Filed* is positive and significant, indicating that an individual is more likely to file a return when the proportion of neighbors filing is greater. However, the treatment dummy variable (*Neighbor Filing Information Dummy*) has a negative and significant coefficient for *Form Filed*, indicating that simply having this information does not increase but rather decreases filing, a result that is consistent with the aggregate results reported in Table 3. Similarly, for the *Reporting Rate* decision, the coefficient on *Lag Number Neighbors Audited* has a positive and significant impact on individual compliance rates, indicating a positive impact of peer effects on the reporting decision when this information is provided. However, the coefficient on the treatment dummy (*Audit Results Dummy*) is not significant. Again, the overall effects show that the mere presence of the information does not necessarily have a positive effect on either filing or reporting, but rather that the levels of behavior complement the filing and reporting behavior.

Thus, information about peer effects has complicated and subtle impacts. These results clearly indicate that peer effects matter; that is, knowing about how one's neighbors are – or are not – complying with the tax laws changes one's own behavior, even if in complicated and perhaps unintended ways.¹³

Other estimation results provide some support for the remaining hypotheses. An increase in the *Audit Probability* for filers (p) has a positive and significant effect on reporting but has no significant effect on filing behavior; this latter result suggests that non-filers are not motivated by the desire to avoid the audit process. An individual who was previously audited (*Lag Own Audited Dummy*) is more likely to report more taxes. These results are consistent with

¹³ Alm, Jackson, and McKee (2009) also find that the information dissemination of audit results often has complicated effects on taxpayer compliance. See also Kastlunger et al. (2009).

Hypothesis 1. Filing is negatively correlated with the cost of obtaining the tax forms (*Cost of Form*), as suggested by *Hypothesis 2*.

The remaining coefficients are generally consistent with results reported in the literature (Alm, Jackson, and McKee, 1992). Filing and reporting are lower for men than for women, and are negatively correlated with wealth. We find no significant difference in the behavioral responses of students versus non-students, and do not include this variable in our final estimations, a result that has been found in other tax compliance experiments.¹⁴

5. Conclusions

Many factors affect an individual's compliance decisions. Our experimental results show that one important factor is information about the behavior of one's peers: individuals are influenced by what their "neighbors" choose to do, at least when this information is provided, even if the precise ways in which this information matters is not always clear-cut. Specifically, we find that providing information on what one's neighbors are doing has a statistically significant and economically large impact on individual filing and subsequent reporting decisions. However, this "neighbor" information does not always improve compliance, depending on the precise way in which this information is provided.

More broadly, our results indicate that strategies to improve compliance must be based on more than improved enforcement only, even though our results clearly show that enforcement (e.g., audits and penalties) have predictable effects on compliance. Instead, what is needed is a multi-faceted policy approach that emphasizes enforcement (or a "punishment paradigm"), but one that also emphasizes other dimensions of taxpayer-tax administration interactions, including

¹⁴ See Alm, Bloomquist, and McKee (2012) for a detailed analysis of these subject pool effects in tax compliance experiments. See Ball and Cech (1996) for a more general analysis of subject pool effects in other experimental settings.

the provision of better services to taxpayers (a “service paradigm”). Importantly, our results are consistent with another paradigm, what might be termed a “trust paradigm”, in which individual views on the reliability of the tax authorities – their “trust” in the ethical behavior of authorities – affects their own individual behavior. This last perspective is consistent with the role of social norms on the compliance decision.¹⁵ In short, there should be a wide range of policies to reflect the equally wide range of motivations that lie behind individuals’ compliance decisions.

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¹⁵ See Alm and Torgler (2011) for a more detailed discussion of these paradigms. Note that the “trust paradigm” is reflected in a range of slightly different but clearly related administrative approaches, with roots in the psychology of taxation (Lewis, 1982; Kirchler, 2007). For example, Kirchler, Hoelzl, and Wahl (2008) explore the interaction between enforcement effort (“power”) and facilitation (“trust”) on the part of the tax authority via a “slippery slope” framework; Muehlbacher, Kirchler, and Schwarzenberger (2011) provide experimental evidence to support this framework. McBarnet (2004) suggests that people may choose to comply willingly (what she terms “committed compliance”), they may choose to comply unwillingly (“capitulative compliance”), they may take full advantage of the law in minimizing their taxes (“creative compliance”), or they may choose non-compliance; appropriate enforcement policies vary with the motivation. Similarly, Braithwaite (2009) argues that individuals are motivated either by “deference” motives or by “defiance” motives and that enforcement actions should be tailored to reflect these different motivations. Also, Frey (1997) discusses how one’s “intrinsic motivation” to obey the law may be crowded out by enforcement actions.

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Table 1. Experimental parameters

Parameter	Values
Income	Low = 10, Mean = 50, High = 100 (in increments of 10)
Audit Probability	0.3 and 0.4
Fine Rate	50%, fixed across all sessions
Tax Rate	35%, fixed across all sessions
Tax Deduction	15%, fixed across all sessions
Cost of Form	\$0, \$1, \$2
Enforcement Probability	0

Table 2. Experimental treatments

Audit Results on Neighbors?	Filing Information on Neighbors?	
	No	Yes
No	T1	T2
Yes	T3	T4

Table 3. Some summary statistics

Variable	Full Sample	T1	T2	T3	T4
Form Filed	0.553 (0.497)	0.613 (0.487)	0.467 (0.499)	0.749 (0.434)	0.514 (0.499)
Reporting Rate	0.494 (0.497)	0.569 (0.485)	0.432 (0.501)	0.635 (0.470)	0.454 (0.496)
Cost of Form	1.123 (0.880)	1.000 (0.999)	2.000 (0.000)	0.332 (0.471)	0.854 (0.750)
Neighbor Filing Information Dummy (=1 if information is disclosed, 0 otherwise)	0.667 (0.471)	0.000	1.000	0.000	1.000
Percent Neighbors Filed	0.547 (0.201)	NA	0.465 (0.158)	NA	0.495 (0.196)
Number Neighbors Audited	1.915 (1.389)	NA	NA	2.572 (1.451)	1.704 (1.320)
Audit Results Dummy (=1 if reported, 0 otherwise)	0.629 (0.483)	0.000	0.000	1.000	1.000
Male Dummy (=1 if male, 0 if female)	0.434 (0.496)	0.400 (0.491)	0.483 (0.499)	0.500 (0.501)	0.392 (0.488)
Age (in years)	26.98 (12.06)	31.675 (13.981)	20.144 (1.624)	29.433 (12.803)	28.619 (12.921)
Student (=1 if student, 0 otherwise)	0.715 (0.452)	0.500 (0.500)	1.000	0.666 (0.472)	0.635 (0.481)
Observations	4204	800	1160	600	1644

Notes: Means are reported with standard deviations in parentheses. “NA” denotes “Not Applicable”.

Table 4: Econometric results

Independent Variables	Dependent Variable	
	Form Filed	Reporting Rate
Constant	0.8243** (0.000)	0.8058** (0.000)
Income	0.0011** (0.000)	0.0001** (0.000)
Wealth	-0.0002** (0.000)	-0.0001** (0.000)
Audit Probability	-0.0186 (0.882)	0.3300** (0.000)
Lag Own Audited Dummy	-0.0278 (0.092)	0.0245* (0.023)
Cost of Form	-0.0742** (0.000)	---
Lag Percent Neighbors Filed	0.1651** (0.003)	---
Lag Number Neighbors Audited	---	0.0106* (0.025)
Audit Results Dummy	---	-0.0239 (0.575)
Neighbor Filing Information Dummy	-0.2202** (0.000)	---
Prepare Own Taxes Dummy	-0.0181 (0.493)	---
Age	-0.0016 (0.231)	0.0012 (0.511)
Male Dummy	-0.0734** (0.005)	-0.1494** (0.000)
Sample (Panels)	3992 (212)	2197 (190)
Chi-squared	151.69	52.42

Notes: The dependent variables are *Form Filed* (=1 if yes, 0 if otherwise) and *Reporting Rate* (=Taxes Paid/Taxes Owed). Standard errors are reported in parentheses. * and ** denote significance at the 5 and 1 percent levels, respectively.

Appendix: Baseline Instructions (T1)

Experiment Overview

- You will be participating in a market simulation that lasts several decision “rounds”.
- In each round, you first complete an earnings task and then make 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 income to report. 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 (this is displayed on the left side of the tax reporting screen). You can choose to claim any amount between 0 and your Income earned for the deduction.
- You have a chance of being audited. Audits are determined completely at random and do not depend on your decisions or the decisions of others. The chance of an audit is displayed on your computer screen.
- 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);
 - In addition, you pay a penalty equal to unpaid taxes plus 50% multiplied by the amount of unpaid taxes.
 - If you claimed *less* in deductions 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.

Figure 1. Tax form before completion by subject

Subject 1

Tax Form

Round 1

Group Earnings Summary

SLAB

100 90 80 70
RED bar is your earnings

Your Earnings Summary

Income earned	Actual	100
Deduction (actual is amount allowed)		10
Taxable Income		90
Taxes Owed or Paid		31
Credits (actual is amount allowed)		10
After Tax Income		79
Penalty (under reporting taxes owed)		
Penalty for late filing		
Cost of Tax Form		
Take Home Income		79

Tax Policy

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

Enforcement Policy

Penalty For Late Filing	10%
Penalty Rate	150%
(penalty = rate x tax owed)	

Unemployment Policy

Periods of filing to qualify	2
Periods unemployment will last	2
Likelihood of becoming unemployed	30%
Payment (based on your average income)	50%

Audit Probability

The likelihood of an audit	40%
----------------------------	-----

Audit Success
 (percent discovered during audit)

Income	100%
--------	------

Individual Income Tax Return

Income 1 Income earned	0	7 8 9 4 5 6 1 2 3 0 Clear
Deductions 2 Allowable reductions in income	0	7 8 9 4 5 6 1 2 3 0 Clear
3 Taxable income	0	
4 Initial taxes owed	0	
Tax Credits 5 Credit	0	7 8 9 4 5 6 1 2 3 0 Clear
Taxes 6 Final taxes owed	0	
7 Income after taxes	0	

Time Remaining (Seconds) = 74

Figure 2. Tax form after completion by subject, before filing

Subject 1

Tax Form

Round 1

Group Earnings Summary

\$LAB

100 90 80 70

RED bar is your earnings

Your Earnings Summary

Income earned	100
Deduction (actual is amount allowed)	10
Taxable Income	90
Taxes Owed or Paid	31
Credits (actual is amount allowed)	10
After Tax Income	79
Penalty (under reporting taxes owed)	
Penalty for late filing	
Cost of Tax Form	
Take Home Income	79

Tax Policy

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

Enforcement Policy

Penalty For Late Filing	10%
Penalty Rate	150%
(penalty = rate x tax owed)	

Unemployment Policy

Periods of filing to qualify	2
Periods unemployment will last	2
Likelihood of becoming unemployed	30%
Payment (based on your average income)	50%

Audit Probability

The likelihood of an audit	40%
----------------------------	-----

Audit Success

(percent discovered during audit)	
Income	100%

Department Of Treasury

Individual Income Tax Return

Income	1	Income earned	90
Deductions	2	Allowable reductions in income	25
	3	Taxable income	65
	4	Initial taxes owed	23
Tax Credits	5	Credit	15
Taxes	6	Final taxes owed	8
	7	Income after taxes	57

Time Remaining (Seconds) = 72

File

Not File

http://econlab4/home/TaxCompliance2/subjectpage_taxform_action.cfm

Figure 3. End-of-round summary screen with audit results (if any)

Subject 1

Round Summary

Round 1

Audit Results: AUDITED

Cumulative Wealth \$58

Your Earnings Summary

	Actual	Filed	Audited	Final
Income earned	100	90	100	100
Deduction (actual is amount allowed)	10	25	10	10
Taxable Income	90	\$65	\$90	\$90
Taxes Owed or Paid	31	23	31	31
Credits (actual is amount allowed)	10	15	10	10
After Tax Income	79	\$82	\$79	\$79
Penalty (under reporting taxes owed)			20	20
Penalty for late filing			0	0
Cost of Tax Form		1	1	1
Take Home Income	79	\$81	\$58	\$58

Auditor's Summary

Group Members Audited: 1

Group Members NOT Audited: 3

Group Size: 4

Tax Policy

Tax Rate 35%

(tax owed = rate x taxable income)

Enforcement Policy

Penalty For Late Filing 10%

Penalty Rate 150%

(penalty = rate x tax owed)

Unemployment Policy

Periods of filing to qualify 2

Periods unemployment will last 2

Likelihood of becoming unemployed 30%

Payment (based on your average income) 50%

Audit Probability

The likelihood of an audit 40%

Audit Success

(percent discovered during audit)

Income 100%

Continue