USING THE THEORY OF REASONED ACTION AND AUDIT REMINDER MESSAGES TO INCREASE TAX COMPLIANCE: AN EXPERIMENTAL STUDY OVER REPEATED PERIODS

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Abstract

This paper examines, through the use of a laboratory experiment, the effects on tax compliance of two types of messages – one consisting of a simple reminder of audit risk and one designed based on the theory of reasoned action (TRA). It extends prior research by incorporating the TRA into persuasive tax compliance messages and by examining the effects of the messages over repeated periods. The results suggest some evidence that the messages have a positive impact across time. In addition, there is evidence that the TRA message increases the amount of income reported when an individual fails to comply fully.

INTRODUCTION

Internal Revenue Service (IRS) estimates place the annual United States tax gap at approximately $450 billion (Internal Revenue Service 20011). Of the $450 billion total tax gap, the IRS estimates that $235 billion is attributable to individual underreporting behavior (Internal Revenue Service 2011). Regulators have expressed interest over the last ten years in reducing the US tax gap as a means of improving the federal deficit (Morgan-Thomas and Levine 2012; Miller 2009; Abrams 2007; Congress Looking to Close "Tax Gap" 2007; Russell 2007; Blanthorne and Selvey 2006). Congress has challenged the IRS to increase the voluntary compliance rate, which has been hovering between 83 and 84 percent for the last 27 years, to 90 percent by 2017 (Christian 2012; Internal Revenue Service 2007). One potential way to reduce the tax gap is through greater enforcement efforts; however, enforcement efforts require large monetary and personnel resources and therefore may not be the most practical way of addressing the tax gap problem (Congress Looking to Close "Tax Gap" 2007) especially given that the IRS budget has been cut in recent years (Christian 2012). Another, potentially less costly, method of trying to close the tax gap is to motivate greater levels of tax compliance through the use of persuasive messages.

The use of persuasive messages to increase compliant tax reporting behavior has been examined in the prior literature since the late 1960's. The types of persuasive messages previously tested tend to fall into two broad categories: messages that remind individuals of the potential for audit and sanctions (Iyer, Reckers, and Sanders 2010; Hasseldine, Hite, James, and Toumi 2007; Schwartz and Orleans 1967; Slemrod, Blumenthal, and Christian 2001; Violette 1989; Hasseldine and Kaplan 1992; Hite 1989; Jackson and Jaouen 1989) and messages that emphasize a moral or social responsibility to report compliantly (Blumenthal, Christian, and Slemrod 2001; Hasseldine et al. 2007; Hite 1997; McGraw and Scholz 1991; Roberts 1994; Schwartz and Orleans 1967; Kaplan, Newberry, and Reckers 1997). While much of the evidence in

regards to the effectiveness of sanction based persuasive messages in increasing tax compliance is mixed, one field study (Hasseldine et al. 2007) found that messages that emphasized an increased risk of audit were more effective in reducing aggressive tax behavior than messages that emphasized a moral appeal or provided information about tax assistance services while a second field study (Iyer, Reckers, and Sanders 2010) found that factual information about penalties and reminders of detection risk both increased voluntary tax compliance over a control group. In these studies and all of the prior studies the effectiveness of the persuasive messages in increasing compliant tax reporting behavior was tested in a single period. In the United States tax system, however, individuals must file and pay income taxes on an annual basis throughout their lifetime. When individuals are in a situation in which they must choose one course of action over another, they evaluate the success of their chosen action based on the consequences of that action and will use their evaluations of their prior choices when making the same decision in the future (Einhorn and Hogarth 1978; Einhorn 1982). Thus, it is important to examine the effectiveness of these messages over multiple, repeated periods.

The theory of reasoned action (Fishbein and Ajzen 1975; Ajzen and Fishbein 1980) and its successor, the theory of planned behavior (Ajzen 1991) are theories of social behavior that have been used successfully in the tax compliance literature to explain overall tax compliance in the United States (Hanno and Violette 1996; Bobek and Hatfield 2003). The theory of reasoned action has also been used to design persuasive messages to influence behavior in other contexts such as littering, condom usage, tobacco usage, and registering for career counseling (Evans 1977; Treise and Weigold 2001; Murphy 2002; Lee, Tsai, and Jih 2006; Lepre 2007; White, Charles, and Nelson 2008), but has not been used to design persuasive messages aimed at increasing compliant tax reporting behavior.

In this study a persuasive message based on the theory of reasoned action is designed by incorporating the findings of prior tax compliance research conducted within the framework of the theory of reasoned action. The effectiveness in increasing tax compliance of both the theory of reasoned action message and a simple audit reminder message is examined. While there is a significant positive message by time interaction for the audit reminder message and a marginally significant positive message by time interaction effect for the theory of reasoned action message, there is not a significant main effect for either message. The interaction effects do, however, provide evidence that the messages have a positive impact on compliance over time. These results illustrate the importance of testing the messages over time rather than just in a single period. In addition, even though the theory of reasoned action message does not have a significant effect on the probability that an individual would report 100 percent of his income, it does have a significant positive main effect on the amount of income that is reported when individuals report less than 100 percent of their income.

This study contributes to the current literature in three ways. First, this study examines the effects of persuasive messages in increasing tax compliance over repeated periods. Previous research has examined only the initial period effect of persuasive messages; however, tax compliance is an activity that is repeated regularly over an individual's lifetime, making it important to consider the effects of the messages over repeated periods. Secondly, prior research results are incorporated into the theory of reasoned action framework and a persuasive message based on the theory of reasoned action is tested. This type of message has been found to be effective in other settings, but it has not been tested in the tax compliance literature. Finally, the messages are tested in a laboratory experiment rather than through a survey based methodology or a field study. The laboratory experiment provides incentives similar to those that exist in the real world context while maintaining a high level of control.

The remainder of this paper is organized as follows. Section I presents a review of the prior literature. Section II describes the experimental design and laboratory procedures employed. The data and statistical analysis are presented in Section III. Section IV concludes the paper with a discussion of the implications and limitations of the research.

LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

Persuasive Messages and Tax Compliance

Prior research has investigated the usefulness of reminding taxpayers about the possibility of audit, sanctions, and penalties in increasing tax compliance (Iyer, Reckers, and Sanders 2010; Hasseldine et al. 2007; Hasseldine and Kaplan 1992; Hite 1989; Jackson and Jaouen 1989; Schwartz and Orleans 1967; Violette 1989). While most of the results have been mixed, some studies, including a field studies conducted in Great Britain (Hasseldine et al. 2007) and Washington State (Iyer, Reckers, and Sanders 2010), have found evidence that these messages can be used effectively to increase tax compliance. Except where noted, prior studies were conducted using a survey type instrument.

Schwartz and Orleans (1967) conducted a field study in which they found that threat of sanction did increase tax compliance over a control group but not over a group who were exposed to an appeal to conscience. Jackson and Jaouen (1989) examined the effects of sanction messages or appeals to conscience on participants' propensity to evade taxes, measured using the tax resistance scale developed by Spicer and Lundstedt (1976), and found that neither message reduced the participants' propensity to evade. Violette (1989) and Hasseldine and Kaplan (1992) compared messages that emphasized legal sanctions to messages that emphasized informal social sanctions. In both studies, participants responded to a hypothetical tax reporting scenario after reading a persuasive message. Violette (1989) found that

participants who were exposed to either a legal sanctions only message or a message that combined both legal and informal social sanctions behaved more compliantly than a control group. Hasseldine and Kaplan (1992) found that neither of the messages tested in their study was effective in increasing tax compliant behavior.

In a field study conducted in Washington State by Iyer, Reckers, and Sanders (2010), the authors examined the effectiveness of two different types of sanction based messages: one that provided factual information about the potential penalties for non-compliance and one that required the recipient to provide the taxing authority additional information that would increase the perception of the likelihood of detection of non-compliance. They found that both messages were effective in increasing compliance over that of a control group. Another field study that examined the effectiveness of sanction based messages was conducted in the United Kingdom by Hasseldine, Hite, James, and Toumi (2007). In this study the authors tested the effectiveness of five different persuasive messages in increasing tax compliance. They found evidence that the three messages that emphasized sanctions were overall more effective at increasing tax compliance than the messages that emphasized citizenship or provided information in regards to available tax assistance services. Hasseldine et al. (2007) began each of the three sanction based messages with the following statement:

> *The Inland Revenue is substantially increasing the number of enquiries into the tax returns of people who have previously reported a turnover of just below £15,000 in successive years. Your 2001 return may be one of those chosen for enquiry. (Hasseldine et al. 2007 pg. 191)*

While not explicitly stated, the objective of the sanction messages presented in the Hasseldine et al. (2007) study also appears to be to increase the recipients' perceptions of the likelihood of audit. Examination of the studies conducted prior to Hasseldine et al. (2007) leads the reader to conclude that, in those

studies, exposure to the sanction based message was expected to either increase the recipients' perceptions of the probability that noncompliance would be detected or to increase the perceived severity of the penalties related to noncompliance. Violette (1989) found that the perceived severity of sanctions was greater for a group of participants presented only with factual information about audit and sanction rates than for a control group that did not receive the factual information. Thus, even messages that do no more than present factual information appear to have an influence on the perceptions of those who receive them.

The Theory of Reasoned Action

The theory of reasoned action (Ajzen and Fishbein 1980; Fishbein and Ajzen 1975) is a theory of social behavior that states that the primary determinant of behavior is intention, and the determinants of intention are attitudes and subjective norms. Intention is whether an individual plans on performing the behavior or not, attitudes are the individual's evaluations, either positive or negative, of performing the behavior, and subjective norms are the individual's perceptions of the social pressures to either perform or not perform the behavior (Fishbein and Ajzen 1975; Ajzen and Fishbein 1980). The relative weight of the attitudes and subjective norms on forming intention will vary based on the individual and the situation. Expressed mathematically, the theory of reasoned action states

$BI = (AB)(W_{AB}) + (SN)(W_{SN})$

Where:

BI = Behavioral Intent

AB = Attitude toward the Behavior

SN = Subject Norms toward the Behavior

W = the relative weight of attitude and subjective norms

The determinants of attitudes towards behaviors are the salient behavioral beliefs, while the determinants of subjective norms are the salient normative beliefs. Behavioral beliefs are an individual's beliefs about the direct consequences of either performing or not

performing the behavior (Fishbein and Ajzen 1975; Ajzen and Fishbein 1980). The linkage between behavioral beliefs and the attitudes toward the behavior are more specifically defined in the expectancy-value view of behavioral attitudes (Fishbein and Ajzen 1975). Normative beliefs are the individual's beliefs about whether the people important to him think he should perform the behavior or not (Fishbein and Ajzen 1975; Ajzen and Fishbein 1980). Individuals may hold many behavioral and normative beliefs about a behavior, but only those that are salient affect attitudes and norms (Fishbein and Ajzen 1975).

Ajzen and Fishbein's (1975) expectancy-value view of behavioral attitudes states that an attitude is a function of an individual's evaluation of the probability that performing a behavior will lead to a specific outcome and the evaluation or relative favorableness of that outcome. The expectancy-value view of attitude formation can be expressed mathematically as

$$AB \propto \sum_{i=1}^{n} b_i \, e_i$$

Where:
AB = Attitude toward behavior X
b_i = the subjective probability that performing behavior X will lead to outcome i
e_i = the evaluation of the outcome i

The theory of reasoned action and its successor, the theory of planned behavior, have both been used to explain overall tax compliance behavior. Hanno and Violette (1996) used the theory of reasoned action framework to examine overall tax compliance behavior in the United States and found that tax compliers evaluated fulfilling their duty as a citizen and their personal moral and ethical obligations as a more desirable outcome to tax compliance than did tax non-compliers. Non-compliers evaluated receiving a larger tax refund as a more desirable outcome to noncompliance than did compliers. Non-compliers also evaluated

avoiding an IRS audit as a more desirable outcome and paying a large percentage of their earnings for taxes as a more negative outcome to compliance than did compliers. Bobek and Hatfield (2003) examined tax compliance in the context of the theory of planned behavior (Ajzen 1991), an extension of the theory of reasoned action that differs only in that it includes a third variable, perceived behavioral control, as a determinant of intention. They found five salient beliefs related to tax compliance in their subject pool. Subjects believed that failing to comply would result in their engaging in illegal behavior, feeling guilty, incurring a penalty, minimizing their taxes paid, and failing to pay their fair share. Three of the beliefs – feeling guilty, incurring a penalty, and minimizing their taxes paid – were included in the list of beliefs identified in the prior study by Hanno and Violette (1996). Beliefs about guilt, tax minimization, fairness, and illegality of behavior differed between compliers and non-compliers in all scenarios while beliefs about penalty incursion differed between compliers and non-compliers for some, but not all scenarios. The theory of reasoned action is not only useful to those who wish to explain a particular behavior, but also to those who wish to influence that behavior (Sheppard, Hartwick, and Warshaw 1988; Randall 1989). Persuasive messages designed based on the framework provided by the theory of reasoned action have been found to be effective in influencing a variety of behaviors including littering (Evans 1977), condom usage (Treise and Weigold 2001), tobacco usage (Murphy 2002), reactions to mobile phone advertisements (Lee, Tsai, and Jih 2006), registering for career counseling (Lepre 2007), and reactions to affirmative action programs (White, Charles, and Nelson 2008).

To influence a specific behavior using persuasive messages, the message must focus on beliefs about the direct consequences of performing or not performing the behavior of interest and not on beliefs about items tangentially related to the behavior (Fishbein and Ajzen 1975; Ajzen and Fishbein 1980). For example, if one wanted to influence individuals to sign up for an alcohol treatment

program, the persuasive communication should not focus on the negative aspects of alcoholism, but rather the direct positive consequences of signing up for the treatment program or the direct negative consequences of not signing up for the treatment program (Ajzen and Fishbein 1980).

Based on the prior research about the salient beliefs related to tax compliance and following the framework provided by the theory of reasoned action, an effective persuasive message would be one that links compliant tax reporting behavior with the positive consequence of avoiding an IRS audit and emphasizes the fact that incurring sanctions and penalties would increase the taxpayer's total tax bill to a level greater than it would have been if the taxpayer had paid honestly to begin with. The purpose of this message would be twofold. The first purpose would be to strengthen the belief that paying one's taxes compliantly will lead to the positive consequence of avoiding an audit. The second purpose is to try to influence the recipients' evaluations of the consequences of compliant and noncompliant behavior such that the payment of a larger percentage of one's income is evaluated less negatively and the incursion of penalties is evaluated more negatively.

Message Believability and Action-outcome Evaluation

For a persuasive communication to influence behavior, it is necessary that the individual receiving the communication believe the information that is presented in the persuasive communication (Fishbein and Ajzen 1975; Ajzen and Fishbein 1980). Message believability has been found to be an important factor affecting message persuasion in various other social advertising domains such as warning labels for dangerous products and messages promoting specific political choices (Andrews, Netemeyer, and Durvasula 1991; Andrews and Netemeyer 1990; Beltramini 1988; Beltramini and Evans 1985; O'Cass 2002; O'Cass and Griffin 2006). Message believability refers to the extent to which the

recipient of the message accepts, or believes, the content of the message (O'Cass and Griffin 2006).

An important factor affecting message believability is the credibility of the source delivering the message. Highly credible sources can increase overall message believability (Andrews, Netemeyer, and Durvasula 1991; Andrews 1989; Andrews and Netemeyer 1990; Arora, Stoner, and Arora 2006; Fishbein and Ajzen 1975; Pornpitakpan 2004). Messages such as those presented in Hasseldine et al (2007) and Iyer, Reckers, and Sanders (2010) that come from a highly credible source, the actual taxing authority, are most likely perceived as believable and therefore increase the recipients' perceptions of their own audit probability. Carnes and Englebrecht (1995) found evidence that not just detection risk, but also taxpayers' perceptions of detection risk influence their tax compliance decisions.

Prior work with messages designed to increase perception of audit probability has been conducted as a one period experiment; however, the act of paying one's taxes is repeated on a regular basis over one's lifetime. Thus, one could argue that the goal of any program designed to increase tax compliance should be to increase tax compliance over the long term and not just in the current period. In order for the message that increases a taxpayer's perception of audit risk to remain effective over repeated periods, the message must remain believable.

Because source credibility is one of the determinants of message believability, source credibility must remain high for continued messages from that source to be viewed as believable. While they do not test their assertion, Alm and McKee (2006) argue that sending letters to taxpayers that increase their perception of audit probability but not backing the letters up with an actual audit will cause the taxing authority to lose credibility. This loss in credibility should then cause a decrease in the believability of future messages received by the taxing authority.

Another factor that has been found to reduce message believability is personal experience that contradicts with the

information contained in the message (Andrews, Netemeyer, and Durvasula 1991). In cases in which direct observation or personal experience conflict with third party information, the direct observation and personal experience are greater determinants of the nature and strength of an individual's beliefs than the third party information (Cialdini, Petty, and Cacioppo 1981; Fishbein and Ajzen 1975; Smith and Swinyard 1982). In addition, Kastlunger, Kirchler, Mittone, and Pitters (2009) find in an experiment requiring repeated tax reporting decisions that participants who were not audited behaved less compliantly over time. Kastlunger et al. (2009) attribute this decrease in compliance to a feeling of safety due to a decreased estimate of audit probability. A relatively small portion of the population in the United States is audited each year. If a mass communication designed to increase the perception of audit probability is used for the purposes of creating a belief that paying ones taxes can lead to an audit, but the majority of the population does not subsequently experience an audit, the loss in source credibility and the conflicting personal experience of the message recipients should lead to decreased message believability and decreased effectiveness of the message when repeated over time.

However, research has also found that when choosing one course of action over another, once an initial decision rule is set, individuals tend to disregard evidence contradicting that initial decision rule. Once an action has been taken, individuals observe the outcomes of their decision to evaluate the effectiveness of the chosen action (Einhorn and Hogarth 1978; Einhorn 1982). Individuals learn from experience by learning action-outcome linkages, which they often misinterpret as cause-effect linkages (Einhorn 1982), and they cognitively categorize outcomes with actions as either success or failures (Estes 1976). This leads to a two by two action-outcome matrix as presented in Figure 1 (Einhorn and Hogarth 1978; Einhorn 1982). When evaluating a decision rule based on outcomes, individuals focus on positive hit rates and ignore the other three cells even when the information

about all four cells is readily available (Einhorn and Hogarth 1978; Einhorn 1982; Ward and Jenkins 1965). Estes (1976) found that participants would only consider the frequency of failing outcomes when specifically instructed to do so. If a mass communication designed to increase the perception of audit probability is initially accepted, establishing the initial decision rule that payment of taxes makes one subject to audit, a lack of audit may be viewed as a false positive and generally disregarded for purposes of evaluation of the initial belief. If this is the case, the communication designed to increase perception of audit risk would not become less effective over time when individuals do not experience an audit. Due to the potential conflicting expectations, I state my first hypothesis in the null form:

> H1: Compliance behavior of individuals not previously subject to audit will not differ significantly over time between those receiving a persuasive message reminding them of the risk of audit and those who are not exposed to any persuasive message.

Figure 1

Action-Outcome Matrix

(Adapted from Einhorn, H. J. 1982. Learning from Experience and Suboptimal Rules in Decision Making. In *Judgment under uncertainty: Heuristics and biases*, edited by D. Kahneman, P. Slovic and A. Tversky. Cambridge, MA: Cambridge University Press.)

	Acceptance of the Decision Rule	**Rejection of the Decision Rule**
Outcome "Success"	Positive Hits	False Negatives
Outcome "Failure"	False Positives	Negative Hits

The message based on the theory of reasoned action attempts to establish a belief that paying one's taxes compliantly will reduce the likelihood that one will experience an audit. Applying this matrix to the current study, acceptance of the decision rule would be to accept the belief that compliant tax behavior leads to the positive outcome of avoidance of an IRS audit and to choose to comply, while rejection of the decision rule would be expected to lead to noncompliant behavior. A success would be a lack of IRS audit while a failure would be incurring an IRS audit.

Individuals who initially accept the decision rule that paying one's taxes compliantly will reduce the likelihood that one will experience an audit and report their taxes honestly and then do not experience a subsequent audit will learn the action-outcome linkage that paying one's taxes honestly leads to absence of an audit. This learned action-outcome linkage should increase belief strength that compliant tax behavior reduces audit probability. Individuals who receive these messages may still believe that their overall chance of an audit is low, but there is evidence that people will use more care than is efficient if they believe that they can reduce a remote risk to zero through careful behavior if the perceived cost of the care taken is less than the perceived reduction in the potential negative consequences (Posner 2005). Individuals that either reject the decision rule initially and then do not experience an audit — a false negative — or accept the decision rule and experience an audit — a false positive —, will likely disregard the observation in evaluating their actions. Thus, the expectation is that a message designed based on the theory of reasoned action would remain effective over time, and I state my second hypothesis in the alternative form:

> H2: Individuals not previously subject to an audit who are exposed to a persuasive message based on the theory of reasoned action will exhibit more compliant

tax reporting behavior over time than individuals who are not exposed to the persuasive message.

METHODOLOGY

Data is gathered through a laboratory experiment. The experimental laboratory design provides a setting in which the effects of the treatments can be examined over repeated periods as the subjects are required to choose a course of action, observe the outcomes of their choice, and then make the same choice again in the subsequent period. This pattern of choice followed by observation of outcome repeated over multiple periods mirrors the tax decision-making context faced by taxpayers over the course of their lifetime.

The sample includes one hundred five students recruited from principles level classes in the College of Business and the Department of Economics at a large university in the Southeastern United States. The study had three experimental groups: a control group and two treatment groups. The first treatment group received a persuasive message reminding them of the existence of an audit risk. The second treatment group received a persuasive message designed based on the theory of reasoned action. The control group received no message. The experiment was conducted in the specific context of taxation. Embedding an experiment in the tax context can help improve parallelism with the real world tax compliance decision context (Alm and McKee 2006).

As the design of the experiment did not require a specific number of subjects to be in the lab at the same time, sessions were run with as few as one experimental subject and as many as eleven. Participants were asked to read and sign a consent form instructing them that all of their decisions and responses would be anonymous, that they would be paid in private at the end of the experiment, and that the only documentation from the experiment that would contain their identity would be the receipt of payment, which would not contain their participant number. Participants were

assigned randomly to one of the three experimental conditions using computer generated participant numbers[1]. In each experimental session, all participants started the experiment at the same time. Participants were not allowed to communicate or interact with each other at any point during the experiment.

Written instructions were provided to the participants through a series of instructional and tutorial screens via the computer terminal, as well as read to them after they logged into the experimental software, but prior to the start of the experiment. Once participants started the experiment, they were not allowed to return to the instructional screens, nor were they given a copy of the instructions. Participants were notified prior to the start of the experiment that they would not be allowed to return to the instructional screens and were required to indicate they understood the instructions before beginning the experiment.

Participants were instructed that the experiment would continue for an unknown number of periods, although the total number of periods for all experimental sessions was predetermined at 20 periods. Participants earned income by proofreading a passage of text and correcting grammatical or spelling errors in the passage. Participants earned income at a rate of $0.35 per error identified and properly corrected. Participants did not earn income for errors corrected improperly, nor were they penalized for false errors identified. Participants were informed in the instructions that each passage would contain five errors. Subjects were given a maximum of two minutes to complete the proofreading task, but were able to submit the proofreading task before the two minutes had expired if they had completed the task.

Once a subject submitted the proofreading task, the amount of income earned from the current period task was reported to the subject in an earnings report and added to the subject's electronic bank. Subjects then moved from the earnings report to the income

[1] The experiment was conducted using computer software that was designed and written for the purpose of completing this research.

tax return. In the control group, subjects moved directly from the earnings task to the income tax return without any additional steps. In the audit reminder (AR) message treatment condition, after subjects left the earnings task, but before they were taken to the income tax return, subjects were taken to a screen that presented the following message that restated the information provided to them in the instructions about audit probability and penalties:

> *REMINDER: The amount of income that you report may be audited for accuracy. If you are found to have reported less than your earned income, you will be required to pay the tax due on the unreported income plus a penalty equal to 1.5 times the unpaid taxes.*

This message is similar to those used in prior research in that it simply provides the reader with a reminder that the risk of audit and penalties exists.

In the theory of reasoned action (TRA) message treatment condition, after subjects left the earnings task, but before they were taken to the income tax return, subjects were taken to a screen that displayed the following persuasive message designed based on the theory of reasoned action:

> *You can reduce your chances of incurring audit and penalties by honestly reporting 100% of your earned income. If you are audited and found to have reported less than your earned income, you will be required to pay the tax due on the unreported income plus a penalty equal to 1.5 times the unpaid taxes. If you have to pay penalties on underpaid taxes, you will be paying more out of pocket than if you had paid 100% of your true tax liability to begin with.*

This message conforms to the theory of reasoned action by linking the action of paying one's taxes honestly with the consequence of reducing one's audit risk and by emphasizing the negative aspects of incurring penalties. In both treatment conditions, the message appeared on the screen for 15 seconds before the navigation button

that allowed the subjects to move to the next screen became available.

On the income tax return screen, subjects were asked to report an amount of income earned for the period and were given an estimate of the tax due on that income. Tax was calculated at a rate of 20 percent of reported income in all periods for all experimental conditions. After subjects finalized their income reporting, the tax due was calculated and deducted from the subjects' electronic banks. The instructions provided at the beginning of the experiment clearly stated that the amount of tax paid in any given period would be calculated based on the reported income rather than the earned income for that period and that subjects should feel free to try to earn as much money as possible during the course of the experiment.

The final step in each period of the experiment was the audit process. In the experimental instructions, subjects were informed that their reported earnings each period might be subject to an audit, that audits would be conducted privately through the computer interface, that audit selection would be determined either randomly or based on a set of audit rules, and that if they were audited and had underreported their income, they would be required to pay the tax due on the unreported income plus a penalty equal to one and a half times the amount of unpaid taxes. The actual selection procedures and true audit probabilities used in the experiment were intentionally left unknown to the subjects. This parallels the situation in the United States tax system in which taxpayers know that they may be subject to an IRS audit but do not know the specific audit selection procedures or their true audit risk. Subjects were notified that they had been selected for audit by a message screen that appeared after they finalized their income reporting but before they were allowed to proceed to the next round. This message screen notified the subject that his reporting had been selected for audit and asked him to navigate to the next screen to see the results of the audit. The results of the audit were displayed on the next screen and any additional amounts due were

deducted from the individual's electronic bank. The individual was then allowed to proceed to a wait screen for the next round of the experiment. Individuals who were not selected for audit were not explicitly told that they had not been selected for audit. They simply advanced to a wait screen for the next round after they finalized their income reporting in the current round.

The audit procedures were designed to ensure that the participants remained blind to the audit probabilities and selection rules. The true audit probability in each period differed based on whether the individual reported the full amount of his earned income or underreported his earned income in that period. In a period in which he reported the full amount of his earned income, an individual was subject to a 1 percent chance of being audited. In a period in which he has underreported his earned income, an individual was subject to a 2 percent chance of audit. The audit probabilities for the periods were chosen to approximate the annual U.S. audit rates of 1 – 2 percent. The completion of the audit process marked the end of the experimental round. Each experimental round proceeded in the exact same manner as the prior periods.

After the completion of all experimental rounds, subjects completed a risk game. The game was a version of the lottery choice game as published in Holt (2002). In this game, participants are presented with ten choices between pairs of gambles. The gambles were presented in a table of two columns and ten rows. For each row, participants chose whether they would rather play the gamble in the left column or the gamble in the right column. The potential payouts of the gambles in each column did not change on a row by row basis, but the likelihood of receiving each payout was different in each row, so that the expected utility of the gamble changed on a row by row basis. When participants checked out of the experiment, one of the rows was chosen at random and the participant played the gamble that he chose for that row.

Table 1
Compliance by Round with Post Audit Observations Dropped
(Rounds 1-10)

Round #		Message Group			
		Control	Traditional	TRA	All
1	Mean	0.9481	0.9629	0.9806	0.9636
	Std Dev	(.1457)	(.1055)	(.0623)	(.1105)
	N	36	34	34	104
2	Mean	0.9366	0.9156	0.9624	0.9379
	Std Dev	(.1430)	(.2053)	(.0922)	(.154)
	N	35	34	33	102
3	Mean	0.9063	0.9103	0.9503	0.9216
	Std Dev	(.1985)	(.2297)	(.1306)	(.1910)
	N	35	34	32	101
4	Mean	0.9132	0.9115	0.9127	0.9124
	Std Dev	(.2194)	(.2108)	(.2215)	(.2149)
	N	34	34	30	98
5	Mean	0.8638	0.925	0.926	0.9041
	Std Dev	(.2673)	(.1809)	(.1468)	(.2068)
	N	34	34	30	98
6	Mean	0.8894	0.9318	0.9613	0.9265
	Std Dev	(.2637)	(.1655)	(.1098)	(.1929)
	N	33	33	30	96
7	Mean	0.8979	0.9148	0.8944	0.9027
	Std Dev	(.2625)	(.2283)	(.1866)	(.2273)
	N	33	33	29	95
8	Mean	0.8806	0.867	0.9186	0.8876
	Std Dev	(.2586)	(.2819)	(.2083)	(.2512)
	N	31	33	29	93
9	Mean	0.898	0.8794	0.9169	0.8977
	Std Dev	(.2525)	(.2547)	(.1693)	(.2278)
	N	30	31	29	90
10	Mean	0.8721	0.8513	0.9169	0.8794
	Std Dev	(.2119)	(.3379)	(.1765)	(.2528)
	N	29	31	29	89

Compliance is the proportion of earned income that is reported. Table presents mean compliance by round for each experimental group with all observations after a participant is audited dropped from the data set. In rounds 1 and 10 a participant earned $0 income and is treated as a missing data point.

Table 2
Compliance by Round with Post Audit Observations Dropped
(Rounds 11-20)

Round #		Message Group			
		Control	Traditional	TRA	All
11	Mean	0.8777	0.8203	0.9014	0.8661
	Std Dev	(.2528)	(.3487)	(.2283)	(.2808)
	N	30	30	29	89
12	Mean	0.8387	0.871	0.905	0.8708
	Std Dev	(.2667)	(.2913)	(.2445)	(.27)
	N	30	30	28	88
13	Mean	0.7843	0.814	0.8721	0.8224
	Std Dev	(.3584)	(.3461)	(.2837)	(.3302)
	N	30	30	28	88
14	Mean	0.7961	0.7867	0.8641	0.8144
	Std Dev	(.3245)	(.3744)	(.3002)	(.3336)
	N	28	30	27	85
15	Mean	0.835	0.809	0.8812	0.8404
	Std Dev	(.309)	(.3604)	(.2566)	(.3110)
	N	28	29	26	83
16	Mean	0.8154	0.8464	0.8888	0.8493
	Std Dev	(.3111)	(.3231)	(.265)	(.2994)
	N	28	28	26	82
17	Mean	0.7833	0.795	0.8638	0.8132
	Std Dev	(.3634)	(.3793)	(.3211)	(.3535)
	N	27	28	26	81
18	Mean	0.7181	0.8204	0.8538	0.798
	Std Dev	(.402)	(.386)	(.2934)	(.3641)
	N	26	28	26	80
19	Mean	0.8112	0.8033	0.8508	0.8215
	Std Dev	(.3219)	(.3835)	(.317)	(.3389)
	N	26	27	26	79
20	Mean	0.726	0.8536	0.8664	0.8168
	Std Dev	(.4)	(.3323)	(.3047)	(.3485)
	N	25	28	25	78

Compliance is the proportion of earned income that is reported. Table presents mean compliance by round for each experimental group with all observations after a participant is audited dropped from the data set. In round 19 a participant earned $0 income and is treated as a missing data point.

Participants were given a written copy of the instructions for the risk game and these instructions were read aloud to them prior to completing the game. Participants also completed a series of attitude surveys and a demographics questionnaire. After the

participants finished the demographics questionnaire, they checked out of the experiment at which time they completed the risk game and were paid in cash for their participation. Participants were checked out individually and payments were made in private. Payment was equal to the cumulative balance in their electronic bank at the end of the final experimental period plus the earnings from the risk game. The average payout was approximately 26 dollars. Each experimental session lasted approximately one and a half hours from check-in to check-out.

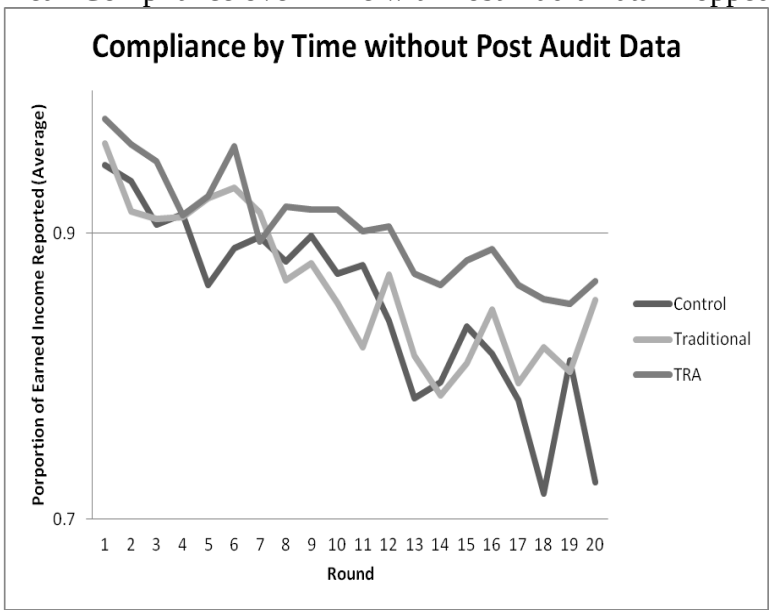
ANALYSIS AND RESULTS

The data was analyzed using random effects panel data Tobit models to control for the within subject correlation and to better model the non-linear relationship of censored data. All observations from rounds prior to which an individual had not experienced an audit are included.

Any observations after an individual experienced an audit are dropped for the purpose of this analysis[2]. Mean compliance, standard deviation, and sample size for each round are presented in Tables 1 and 2. A graph of mean compliance over time is presented in Figure 2.

[2] Observations occurring after audit are dropped due to the fact that the research question relates to behavior when no audit has occurred. To examine whether including observations after an individual was audited changes the results, the random effects panel two limit Tobit models are rerun with all observations included (untabulated). The results do not change substantially when the post audit data is included in the model.

Figure 2
Mean Compliance over Time with Post Audit Data Dropped



The results of the Tobit analysis are presented in Table 4, while descriptions of the variables are presented in Table 3. The discussion of the results is limited to the fourth model. There is no main effect for either the AR message (z = .54, p = .590) or the TRA message[3] (z =-.2, p = .843), but there is a significant negative main effect for time (z = -7.13, p = .000) indicating that compliance decreases over time. The decrease in compliance over time when no audit occurs is consistent with Kastlunger et al. (2009). The interaction between the AR message and time has a significant positive effect (z = 2.13, p = .033) and the interaction between the TRA message and time is marginally significant and positive (z = 1.70, p = .088).

[3] The models are also run with the TRA message group as the intercept to examine differences between the TRA message group and the AR message group. No significant differences are found.

Table 3
Definitions of Variables

Variable Name	Definition of Variable
Compliance	Dependent variable measured as proportion of earned income that is reported.
AR Message Group	1 if the participant was in the AR message group, 0 otherwise.
TRA Message Group	1 if the participant was in the TRA message group, 0 otherwise.
Time	Round number – ranges from 1 to 20.
Gender	0 if the participant is male, 1 if the participant is female.
Income Level	1, 2, or 3 based on whether the participant indicated their family income was below average, about average, or above average respectively when compared to other students at the university.
Tax Return	0 if the participant has never filed a U.S. income tax return, 1 if they have filed a U.S. income tax return.
Audit Familiarity	0 if the participant reported that they did not know anyone who had been subject to an IRS audit, 1 if they reported they did know someone who had been subject to an IRS audit.
Risk	Measured using the Holt 2002 lottery choice game. Scores range from 1 to 10 with higher values indicating greater risk aversion.
Morality of Tax Evasion	0 if the participant indicated that they did not believe tax evasion was immoral, 1 if they indicated that they did believe tax evasion was immoral.
Honesty and Personal Values	Measured using a subset of the ten most relevant questions from the Honesty and Personal Values Scale (Robinson, Shaver, and Wrightsman 1991). Scores range from 1 to 10 with higher values indicating less honest personal attributes.
Civic Attitudes	Measured using a subset of the ten most relevant questions from the Social Attitudes Scale (Harris 1957; Robinson, Shaver, and Wrightsman 1991). Scores range from 10 to 50 with higher values indicating greater attitudes of social responsibility.

The decrease in compliance over time when no audit occurs is consistent with Kastlunger et al. (2009). The interaction between the AR message and time has a significant positive effect ($z = 2.13$, $p = .033$) and the interaction between the TRA message and time is marginally significant and positive ($z = 1.70$, $p = .088$).

While there is no main effect for either message, there is a time interaction which suggests that the messages reduce the severity of the decrease in compliance over time in comparison to the control group. This would fail to support H1 that individuals receiving the AR message would not be more compliant over time than the control group, and would provide some support for H2 that individuals viewing the TRA message would be more compliant over time than the control group. In addition, gender is marginally significant ($z = 1.83$, $p = .067$) indicating greater tax compliance for females over males. Risk aversion has a significant positive effect ($z = 2.33$, $p = .02$), and lower honesty and personal values has a significant negative effect ($z = -3.84$, $p = .000$).

As an additional analysis, I relax the assumption of the Tobit model that both the probability that an individual will be 100 percent compliant and the proportion of income reported by non-compliant individuals is controlled by the same mechanism and test the hypotheses using both a Probit model and a generalized least squares regression (Cameron and Trivedi 2009). The random effects Probit model is run with a dichotomous dependent variable of 1 = 100 percent of earned income reported and 0 = anything less than 100 percent of earned income reported. The Probit model examines the effects of the variables on the probability that an individual would report 100 percent of their earned income. For the random effects generalized least squares model the compliance variable is measured as the proportion of earned income that was reported. Only those observations where the proportion was less than 1.0 are included in the model. The general least squares model examines the effects of the variables on the proportion of income reported in periods for which individuals underreport.

Table 4
Tests of the Effect of Message Group on Compliance - Random Effect Panel Data Two Limit Tobit Models

Main Independent				
AR Message Group (1 = AR Message Group)	0.014 (.249)	0.035 (.250)	0.065 (.251)	0.135 (.250)
TRA Message Group (1 = TRA Message Group)	-0.051 (.256)	-0.028 (.256)	-0.005 (.255)	-0.05 (.251)
Time	-0.039*** (.005)	-0.039*** (.005)	-0.039*** (.005)	-0.039*** (.005)
AR * Time	0.016** (.008)	0.016** (.008)	0.016** (.008)	0.016** (.008)
TRA * Time	0.013* (.008)	0.013* (.008)	0.013* (.008)	0.013* (.008)
Demographics				
Gender (1 = female)		0.448** (.195)	0.453** -0.198	0.362* (.198)
Income Level		-0.438*** (.157)	-0.461*** (.157)	-0.246 (.157)
Tax Experience				
Tax Return (1 = has filed a tax return)			0.131 (.205)	0.031 (.201)
Audit Familiarity (1 = knows someone who has been audited)			0.271 (.258)	0.078 (.258)
Attitudes and Preferences				
Risk				0.179** (.077)
Morality of Tax Evasion (1 = believes that tax evasion is immoral)				-0.231 (.290)
Honesty and Personal Values				-0.176*** (.046)
Civic Attitudes				-0.009 (.022)
constant	2.25*** (.189)	2.51*** (.272)	2.38*** (.290)	4.64*** (1.39)
Participants	105	105	105	105
Observations	1799	1799	1799	1799
Pseudo R-Squared	0.0636	0.0713	0.0725	0.0849

* Significant at p < .1, **Significant at p < .05, ***Significant at p < .01
Table presents parameter estimates with standard errors in parentheses.

For the Probit model and the generalized least squares model, I run the analysis on only the most complete model with the independent

variables of interest and all control variables included. The results of these tests are presented in Table 5.

The results of the Probit model are similar to those of the Tobit model. There is no main effect for either the AR message (z = .42, p = .672) or the TRA message (z = -.6, p = .552), but there is a negative main effect for time (z = -4.47, p = .000), indicating that the probability that an individual will report 100% of their earned income decreases over time.

Both the interaction effect for the AR message group and time (z = 3.11, p = .002) and the TRA message group and time (z = 2.23, p = .026) are positive and significant indicating that the messages have a positive impact on the severity of the over time reduction in the probability that an individual will report 100 percent of their income. Gender has a marginally significant positive effect (z = 1.87, p = .061), risk aversion has a significant positive effect (z = 2.37, p = .018), and lower honesty and personal values has a significant negative effect (z = -3.85, p = .000).

The results of the random effects generalized least squares model differ from both the Tobit model and the Probit model, suggesting that the messages have a different effect on the amount of income reported when an individual reports less than 100 percent of their earned income than they do on the probability that an individual will report 100 percent of their earned income. There is no significant main effect for the AR message (z = .44, p = .658) in this test, but there is a significant positive main effect for the TRA message (z = 2.55, p = .011), suggesting that receiving the TRA message increases the amount of earned income reported when an individual reports less than 100 percent of their income.

Table 5
Two Part Test of the Effect of Message Group on Compliance

	Probit Model	GLS Model
Independent		
AR Message Group	0.257	0.04
(1 = Traditional Message Group)	(.608)	(.091)
TRA Message Group	-0.366	0.231**
(1 = TRA Message Group)	(.615)	(091)
Time	-0.077***	-0.02***
	(.017)	(.003)
AR * Time	0.070***	-0.003
	(.022)	(.004)
TRA * Time	0.052**	-0.003
	(.023)	(.004)
Demographics		
Gender	0.881*	-0.032
(1 = female)	(.471)	(.077)
Income Level	-0.473	-0.118**
	(.379)	(.053)
Tax Experience		
Tax Return	0.251	-0.116
(1 = has filed a tax return)	(.480)	(.079)
Audit Familiarity	-0.222	0.178*
(1 = knows someone who has been audited)	(.618)	(.092)
Attitudes and Preferences		
Risk	0.432**	0.02
	(.183)	(.027)
Morality of Tax Evasion	-0.687	0.168*
(1 = believes tax evasion is immoral)	(.701)	(.102)
Honesty and Personal Values	-0.422***	-0.014
	(.110)	(.017)
Civic Attitudes	-0.023	-0.002
	(.052)	(.008)
constant	8.48**	0.894*
	(3.29)	(.516)
Participants	105	46
Observations	1799	439
Pseudo R-Squared	0.0493	0.3530

* Significant at p < .1, **Significant at p < .05, ***Significant at p < .01
Table presents parameter estimates with standard errors in parentheses.

The main effect for time is negative and significant (z = -7.20, p = .000) in this model as well, indicating that over time,

individuals who are reporting less than 100 percent of their income report a smaller proportion of their earned income. Neither the interaction of the AR message and time ($z = -.84$, $p = .403$) or the TRA message and time ($z = -.65$, $p = .514$) are significant suggesting that the messages do not have an effect on the magnitude of the reduction in proportion of income reported over time. Income is significant and negative ($z = -2.21$, $p = .027$) indicating the higher the perception of family income levels, the lower the proportion of income reported when an individual reports less than 100 percent of their income. Knowledge of someone who has experienced an IRS audit is positive and marginally significant ($z = 1.92$, $p = .054$) indicating that individuals who know someone who had been audited by the IRS report a greater proportion of their income if they are reporting less than 100 percent. Tax morality is positive and marginally significant ($z = 1.65$, $p = .099$) providing some evidence that individuals who believe tax evasion to be immoral report a greater proportion of their earned income when reporting less than 100 percent.

CONCLUSION

This study extends prior literature by incorporating findings from prior theory of reasoned action tax compliance research into a persuasive message designed to increase tax compliance. This message and a simple audit reminder message are tested over repeated periods to examine their effectiveness across time.

Like all research, this study is subject to limitations. The main limitation of this study is that, while measures were taken to increase parallelism between the laboratory and the real world context, the laboratory is an artificial environment and is not able to incorporate all aspects of the real world context. One major instance in this study in which the laboratory environment differs from the real world context is in the timing of the tax payment, audit notification, and repetition of the taxpaying cycle. A process that is spread out over years in the real world is condensed into a

series of periods that can be completed within an hour to an hour and a half in the laboratory.

While there is no main effect for either the AR or TRA messages, the AR message has a significant counteractive effect and the TRA message has a marginally significant counteractive effect on the overall across time decrease in compliance. As tax reporting is an activity that is repeated over an individual's lifetime, a message that has a positive impact on tax compliance across time may be an effective tool in reducing the tax gap. In addition, while a Probit model that examined the effect of the variables on the probability that an individual would comply fully had similar results to the Tobit model, when examining only instances in which the individual reported less than 100 percent of their earned income, the TRA message has a positive impact on the amount of income reported. The results of the two part analysis suggest that different decision mechanisms and factors are important when an individual is making the decision to comply fully or not versus when an individual is deciding by how much to underreport. As the IRS recognizes that it will not be possible to fully eliminate the tax gap (Internal Revenue Service 2007), influencing both the decision to comply fully and the magnitude of the underreporting when not complying fully can play an important part in their efforts to reduce the tax gap. These results emphasize the need to consider both decisions in tax compliance research and suggest that in the effort to reduce the tax gap, a program which includes multiple strategies will be the most effective. Future research should be completed to more fully examine how the decisions differ and determine the most appropriate strategies to influence each decision.

Additional analyses that include observations after an individual was audited do not yield substantially different results. Contrary to expectations, this suggests that the presence or absence of an audit to reinforce the content of the message does not have an impact on the effectiveness of the message. The lack of difference may due to the complex nature of a taxpayer's reporting behavior

post audit as documented by the mixed research results in this area (Boylan 2010), or it may be due to the fact that because of the low audit rates in the current study, only approximately 14 percent of the total observations occurred after audit. It might be fruitful in future research to design a study that would provide a more even percentage of post audit observations across treatment groups to more closely examine the effects of both the messages and audit and the interactions of the messages and audit on tax compliance.

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