

JATA  
Vol. 23, No. 1  
Spring 2001  
pp. 75-90

## ***RESEARCH NOTE***

### **Experimental Evidence on the Relation between Tax Rates and Compliance: The Effect of Earned vs. Endowed Income**

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#### **ABSTRACT**

In this paper, we report the results of an experiment designed to determine whether the manner in which income is obtained (earned vs. endowed) affects the relation between tax rates and taxpayer compliance. Our experiment consisted of an income phase and a tax-reporting phase. In the income phase, participants were either endowed with \$20 or were required to earn \$20 by performing a one-hour multiplication exercise. In the tax-reporting phase, participants decided how much of their \$20 in income to report on their tax returns. Consistent with prior experimental evidence, we find that when income is endowed, participants respond to a tax rate increase by reporting less taxable income. In contrast, but consistent with economic theory and some archival-empirical evidence, we find that when income is earned, participants respond to a tax rate increase by reporting more taxable income. Collectively, the results suggest that income is not a fungible commodity and that taxpayer responses to changes in policy variables such as the tax rate may depend critically on the amount of time and effort required to generate income. Additionally, our results may help explain differences between the results of taxpayer compliance experiments (which typically endow individuals with income) and archival-empirical studies (which use data that typically include earned income) regarding how changes in the tax rate (and other factors) affect taxpayer compliance decisions.

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We appreciate the helpful comments of Jim Andreoni, Fran Ayres, Jake Birnberg, Walt Blacconiere, Robert Bloomfield, Sarah Bonner, Harry Evans, Pete Frischmann, Frank Hodge, Vicki Hoffman, Pat Hopkins, Karla Johnstone, Steve Kachelmeier, Robert Libby, Lauren Maines, Don Moser, Mark Nelson, Joel Pike, Tim Pollock, Jamie Pratt, Jerry Salamon, Jim Seida, Jim Wahlen, Terry Warfield, Connie Weaver, two anonymous reviewers, and the participants at the Cornell University, Indiana University, Michigan State University, University of Pittsburgh, University of Utah, and Xavier University Accounting Research Workshops. We are grateful for financial support from the Department of Accounting and Information Systems at Indiana University, the Williams School of Commerce, Economics, and Politics at Washington and Lee University, and the Department of Accounting and Information Systems at the University of Wisconsin-Madison. We also are grateful to Don Moser, Cynthia Vines, and Martha Wartick for allowing us to examine their experimental materials.

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Submitted: August 1999

Accepted: October 2000

**Data Availability:** Data gathered in this study are available from the authors upon request.

## INTRODUCTION

In this paper, we provide experimental evidence on the relation between tax rates and taxpayer compliance and how this relation is influenced by the manner in which taxable income is obtained (earned vs. endowed). These issues are of interest for tax policy and to tax researchers for at least two reasons. First, tax rates are a highly visible, widely mentioned, and an often adjusted policy variable (Calmes and Murray 2000; Stevenson 2000; *Wall Street Journal* 2000). However, our understanding of how changes in the tax rate affect taxpayers' compliance decisions is limited (Andreoni et al. 1998, 839). Consequently, changes in tax rates could produce unintended negative consequences on the effectiveness, efficiency, and perceived fairness of the tax system. In light of this observation, a better understanding of how taxpayers respond to tax rate changes is needed.

Second, our experiment addresses an issue that may help to reconcile seemingly conflicting prior evidence regarding how changes in the tax rate affect compliance. Specifically, prior experimental research almost uniformly indicates that increasing the tax rate has a negative, or no, effect on compliance (e.g., Friedland et al. 1978; Baldry 1987; Alm et al. 1992; Moser et al. 1995). Prior archival-empirical research, though, offers mixed results, with some studies finding a negative relation between tax rates and compliance (e.g., Clotfelter 1983) and other studies finding, consistent with economic theory, a positive relation between tax rates and compliance (e.g., Feinstein 1991; see Andreoni et al. 1998, 839). One possible reason for these conflicting findings is that in prior experiments participants were endowed with income, whereas archival-empirical studies employ data that typically includes earned income. Moreover, given prior research, it is difficult to conclude that the relation between tax rates and compliance is anything other than ambiguous. Thus, reconciling the differences between experimental evidence, archival-empirical evidence, and economic theory could help improve our understanding of the relation between tax rates and compliance. This sentiment is echoed by Andreoni et al. (1998, 839) who note, "given the importance of this topic [the effect of tax rates on compliance], it surely deserves further investigation."

To determine whether the manner in which income is obtained (earned vs. endowed) influences taxpayer responses to a change in the tax rate, we designed an experiment consisting of two phases: (1) an income phase, and (2) a tax-reporting phase. In the income phase, participants were either endowed with \$20 or were required to earn \$20 by performing a one-hour multiplication exercise. In the tax-reporting phase, participants decided how much of their \$20 in income to report on their tax returns. More specifically, participants were informed that the amount of money they received at the end of the experiment would depend on how much income they reported on their tax return and whether their tax return was audited. In addition, all participants were informed of the audit probability (25 percent), the tax rate (either 20 percent or 40 percent), and the penalty assessed on any underreported income detected by an audit (150 percent of the tax evaded). Moreover, we structured the tax-reporting phase of the experiment and the associated parameter values to be consistent with prior research (e.g., Friedland et al. 1978; Baldry 1987; Beck et al. 1991; Collins and Plumlee 1991; Alm et al. 1992; Moser et al. 1995; Vines and Wartick 1998; Wartick et al. 1999).

Our results suggest that the manner in which income is obtained has a substantial effect on taxpayer compliance responses to a change in the tax rate. In particular, consistent with prior experimental evidence (and some archival-empirical evidence), when income was endowed, participants responded to an increase in the tax rate by reporting *10 percent less* taxable income. In contrast, but consistent with economic theory (and some archival-empirical evidence), when income was earned, participants responded to an increase in the tax rate by reporting *43 percent more* taxable income. Collectively, the results of our experiment suggest that income is not a fungible commodity and that individuals treat their income differently depending on the amount of time and effort required to obtain it. Thus, taxpayer responses to changes in policy variables such as

the tax rate may depend critically on the means by which income is obtained. Further, our results may help explain observed differences between the results of taxpayer compliance experiments (which typically endow individuals with income) and archival-empirical studies (which use data that typically include earned income) regarding how changes in the tax rate and other compliance-related factors affect taxpayer compliance decisions.

The rest of this paper is organized into four sections. The next section develops the hypotheses, and the third section presents the experimental design. Section four reports the results of the analyses. The results are summarized and discussed in section five.

## BACKGROUND AND HYPOTHESES

One of the principal vehicles for studying taxpayer compliance issues is the basic economic deterrence model (Allingham and Sandmo 1972; Yitzhaki 1974) (hereafter "ASY model"). In the ASY model, taxpayers must decide how much taxable income to report on their tax returns. Reported income is taxed at a nominal rate, and all returns face an exogenous probability of being audited. If underreporting is detected by an audit, taxpayers pay a penalty that is proportional to the amount of tax evaded. The solution to this model assumes that taxpayers make reporting decisions that optimally trade off the risks and expected returns associated with the underreporting of taxable income.

The ASY model is useful because it yields predictions regarding how compliance behavior should change in response to changes in policy variables of interest, such as the tax rate. For instance, the model predicts that compliance levels typically should increase in response to an increase in the tax rate.<sup>1</sup> The intuition behind this result is that changing the tax rate changes the risk-return trade-off of the compliance problem in two fundamental ways (also see Moser et al. [1995, 621] for a discussion of this result). First, as tax rates increase the spread in payoffs between the good outcome (no-audit) and the bad outcome (audit) increases.<sup>2</sup> Thus, for any given level of evasion, the "tax-evasion-gamble" becomes more risky as tax rates increase, implying that risk-averse taxpayers should mitigate the increased risk by reporting more income on their tax returns. Second, as tax rates increase, a taxpayer's expected payoff (after-tax income) decreases (whether audited or not). Thus, taxpayers who exhibit decreasing absolute risk aversion should respond to the expected decrease in wealth resulting from an increase in the tax rate by reporting more income on their tax returns.<sup>3</sup> In essence, the economic deterrence model predicts that, *ceteris paribus*, an increase in the tax rate jointly increases risk and decreases expected wealth, thereby leading to higher levels of compliance from a large class of risk-averse taxpayers.

Given the importance of understanding how changes in the tax rate affect compliance, numerous studies have examined how taxpayers respond to a change in the tax rate. In contrast to the predictions of the ASY model (and others), prior experimental research examining this issue almost uniformly reports that an increase in the tax rate has a negative or no effect on compliance (e.g., Friedland et al. 1978; Baldry 1987; Beck et al. 1991; Collins and Plumlee 1991; Alm et al.

<sup>1</sup> Examples of other economic models that predict a positive relation between tax rates and compliance include Graetz et al. (1986), Reinganum and Wilde (1986), Beck and Jung (1989), and Erard and Feinstein (1994).

<sup>2</sup> For example, suppose a taxpayer has income,  $I$ , where reported income is taxed at a nominal rate,  $t$ . Further, if underreported income is detected by an audit, then taxpayers are penalized at a rate,  $p$ , that is proportional to the amount of tax evaded. If unaudited, then the taxpayer's payoff for reporting " $x$ " is  $I - tx$ . If audited, then the taxpayer's payoff is  $I - It - tp(I - x)$ . The spread in payoffs is the difference between these two expressions and is equal to  $t(1 + p)(I - x)$ . Notice that for any level of evasion (i.e., for any  $x < I$ ) this final expression is positive, implying that the spread between payoffs widens as the tax rate,  $t$ , increases.

<sup>3</sup> Decreasing absolute risk aversion is a common assumption in many decision-making contexts (e.g., Allingham and Sandmo 1972, 328; Yitzhaki 1974, 201; Beck and Jung 1989, 8) and suggests that individuals' aversion to risk is inversely related to their wealth (i.e., aversion to risk increases as wealth decreases). Because expected wealth (i.e., after-tax income) decreases as the tax rate increases, taxpayers who exhibit decreasing absolute risk aversion should respond to the decrease in expected wealth by reporting more income, thereby taking less risk.

1992; Moser et al. 1995).<sup>4</sup> Archival-empirical evidence, though, is mixed; some studies (e.g., Clotfelter 1983) find a negative relation between tax rates and compliance, while other studies (e.g., Feinstein 1991; see also Andreoni et al. 1998, 839) find a positive relation between tax rates and compliance.

With regard to the mixed archival-empirical findings, however, research that finds a negative relation between marginal tax rates and compliance typically examines a cross section of taxpayer data for a given filing year and, therefore, treats both tax rates and income levels as independent variables. Since these variables are highly correlated (i.e., people who earn more income typically face higher marginal tax rates), it is difficult to separate their effects (Andreoni et al. 1998, 839). To correct for this problem, Feinstein (1991) used Taxpayer Compliance Measurement Program (TCMP) data for two separate years, 1982 and 1985. Since marginal tax rates changed over this time period, Feinstein (1991) was able to examine how different tax rates affected compliance while holding income levels (or intervals) constant. Further, as previously mentioned, Feinstein (1991) found a positive relation between marginal tax rates and compliance levels, consistent with the general prediction from the ASY model.

To improve our understanding of the relation between tax rates and compliance, it is important to examine factors that may help reconcile the differences in results from prior experimental research, prior archival-empirical research, and the predictions derived from economic theory.<sup>5</sup> We believe that one such factor that may moderate the relation between tax rates and compliance and, therefore, may help explain the conflicting findings in the literature, is whether taxable income is earned or endowed. First, although there are numerous differences between experimental and archival-empirical studies, one notable difference is that in experimental studies participants are usually endowed with (given) income, while the data used in archival-empirical studies is comprised of earned income.<sup>6</sup> Second, while standard expected utility theory posits that the manner in which income is obtained should not affect taxpayer compliance decisions, empirical work in

<sup>4</sup> Beck et al. (1991) provide some experimental evidence of a positive relation between tax rates and compliance. However, Beck et al. (1991) did not use the Allingham and Sandmo (1972) and Yitzhaki (1974) framework. Rather, in Beck et al. (1991) taxpayers were unaware of their true taxable income when making their reporting decision, yet they were held accountable for differences between their report and the *ex post* true income level. Given that evasion has been theorized to be inversely related to uncertainty (e.g., Alm 1988; Scotchmer 1989), it follows that participants' decisions in Beck et al. (1991) might have been driven primarily by concerns related to uncertainty, thus mitigating any tendencies to become more aggressive in response to tax rate increases that appear to prevail in experiments in which taxable income is known. Additionally, Moser et al. (1995) suggest that the results of Beck et al. (1991) might be attributable, in part, to their use of neutral, rather than tax, terminology in their experimental instrument.

<sup>5</sup> One criticism of most economic models of taxpayer behavior is that they tend to predict more evasion than actually is observed. Numerous behavioral and sociological theories have been advanced in an effort to bridge this gap (e.g., Cialdini, 1989; see also Andreoni et al. 1998, 850–852). These theories typically offer explanations for why absolute levels of taxpayer compliance are higher than what one might expect based on economic models of taxpayer compliance and, thus, tend to be silent on the issue regarding how taxpayers respond to changes in policy variables.

<sup>6</sup> Some other notable differences between experimental and archival-empirical studies are that, in the real world, taxpayers might believe that audit rates are increasing in income, and hence increasing in tax rates. Since the probability of an audit is theoretically posited to have a positive effect on the level of compliance, this also may account for the observed differences in the results of experimental and archival-empirical research. Additionally, in the real world, taxpayers can respond to an increase in the tax rate with an increase in leisure, making the effect of changing the tax rate on reported income ambiguous (Pencavel 1979) since the work and reporting decision is joint (e.g., the results of Swenson [1988] and Collins and Plumlee [1991]). Finally, other factors in the real world such as variations in effort levels, whether a taxpayer has had a "good" or "bad" year, and/or whether a taxpayer has the financial resources to cover taxes and penalties owed also might significantly influence taxpayer compliance behavior, and therefore account for differences in results regarding the relation between tax rates and compliance.

economics and behavioral decision making suggests that compliance decisions likely will be affected by whether income is earned or endowed.

Specifically, prior research in the field of consumer choice suggests that individuals do not treat income as a fungible commodity (e.g., Ishikawa and Ueda 1984; Thaler 1992, 107–121; Winnett and Lewis 1995; Heyndels and Van Driessche 1998). This research indicates that individuals allocate income to “mental accounts” according to the underlying characteristics of the income and are predisposed to treat income from one account differently than income from another account. It is therefore possible that taxpayers engage in similar mental accounting exercises and segregate income by source. For example, taxpayers might segregate their income by the amount of time and effort required to generate it, with income requiring a lot of time and effort to generate being treated differently than income requiring little time and effort to generate.

For income that requires little or no time and effort to generate (endowed income), we posit that taxpayers are likely to view such income as a windfall gain. Further, prior research indicates that individuals engage in more risk-seeking behavior in the presence of prior gains (e.g., Thaler and Johnson 1990; Keasey and Moon 1996). In essence, when endowed with (given) income, individuals are likely to behave as if they are playing with “house money” and thus are likely willing to accept more risk when making decisions based on this income. This effect is posited to occur because “after a gain, subsequent losses that are smaller than the original gain can be integrated with the prior gain, mitigating the influence of loss-aversion and facilitating risk-seeking” (Thaler and Johnson 1990, 657).

If one extends the house money effect to a taxpayer compliance setting, then compliance should decrease as the tax rate increases when income is endowed. This is likely to occur because, in a taxpayer compliance setting, if individuals treat their income as “house money” then they will behave in a risk-seeking fashion, making it appear that their compliance decisions are being guided to a large extent by expected after-tax returns. Further, under the ASY model increases in tax rates will decrease expected returns (i.e., expected after-tax income), and decreasing one’s reported income increases one’s expected return, *ceteris paribus*.<sup>7</sup> Consequently, it follows that if a taxpayer wishes to maintain a particular expected return, then s/he must report less income in order to offset the negative effect (on expected returns) of a tax rate increase. This leads to the first hypothesis (stated in alternative form):

**H1:** When income is endowed, there will be a negative relation between tax rates and reported income levels.

For income that requires effort and time to generate (earned income), however, we posit that taxpayers are likely to attach a nontrivial monetary value to the opportunity cost associated with earning this income (i.e., a reservation wage). That is, although the costs associated with the time and effort required to generate income are sunk at the time of the reporting decision, taxpayers are unlikely to ignore these costs. Here, we appeal to another body of work in behavioral economics, the literature on sunk costs.<sup>8</sup>

While neo-classical economic theory posits that individuals should make decisions based only on the incremental benefits and costs, anecdotal and empirical evidence suggests that individuals frequently make decisions based on sunk costs (Thaler 1980; Staw 1981; Arkes and Blumer 1985). Such behavior often is referred to as the sunk cost fallacy and arises when decision makers, who have invested substantial money, time, or effort into a project, wish to avoid the feeling or appearance of having squandered resources (Arkes and Blumer 1985, 137). Thus, rather than abandon

<sup>7</sup> Decreasing one’s reported income, though, also increases risk in the sense that it increases the spread between good (no-audit) and bad (audit) payoffs. This is likely one reason why taxpayers simply do not report \$0 in order to achieve the highest possible expected return.

<sup>8</sup> The sunk cost and house money concepts are related in the sense that both “effects” arise when decision makers allow their decisions to be influenced by the outcomes of prior events that have no economic consequences on future decisions.

a project even when it is economically rational to do so, individuals may continue the project and throw "good money after bad money."

The sunk cost fallacy, though, is not limited to investment decisions and the effect can manifest itself in other ways. For example, in a taxpayer compliance setting the sunk costs at the time of the reporting decision are the costs associated with the time and effort required to earn income.<sup>9</sup> Further, if taxpayers exhibit the sunk cost fallacy and attach a monetary value (reservation wage) to the time and effort required to earn income, then they are likely to choose a compliance level that ensures their after-tax income at least exceeds this monetary value (reservation wage). That is, taxpayers will choose to report an income level so that, even if they are audited, their after-tax income covers the perceived cost of the time and effort required to initially earn the income.

This focus on choosing a compliance level based on reservation wage considerations suggests that compliance will increase as the tax rate increases when income is earned. Again, our prediction follows directly from two facts established by the ASY model. First, in the event of an audit, an increase in the tax rate decreases one's after-tax return. Second, in the event of an audit, higher levels of reported income lead to higher payoffs (because higher reported income implies smaller penalties). It therefore follows that if a taxpayer wishes to maintain a particular reservation wage (which necessitates focusing on the "if-audited" outcome), then the taxpayer must report more income in order to offset the negative effects of a tax rate increase. This leads to the second hypothesis (stated in alternative form):<sup>10</sup>

**H2:** When income is earned, there will be a positive relation between tax rates and reported income levels.

Together, H1 and H2 imply that the manner in which income is obtained (earned vs. endowed) will interact with changes in the tax rate in determining taxpayer compliance decisions. H1 and H2 do not, however, indicate whether this interaction will be ordinal or disordinal.

Based on the arguments used in developing H1 and H2, one might posit that reservation wage concerns (which we argue are more prevalent when income is earned) will cause compliance levels to be uniformly higher when income is earned relative to when it is endowed. There are, though, two reasons this may not occur. First, when tax rates are sufficiently low or pretax income is sufficiently high, reservation wage concerns are likely to be trivially satisfied. In such cases, observed compliance behavior might not depend on whether income is earned or endowed because it is unlikely that there will be a differential reservation wage impact across income sources (earned and endowed). Second, when reservation wage concerns are satisfied, some prior research in economics suggests that individuals who earn their income actually might behave more aggressively (i.e., report less income) than individuals who are endowed with income. Support for this notion comes from the bargaining literature (e.g., Ayres 1985), which has established that individuals who earn certain property rights are more aggressive in exploiting those rights than those who have been endowed with economically equivalent property rights (e.g., Hoffman and Spitzer 1985; Hoffman et al. 1994; Frey and Bohnet 1995; Sonnegard 1996). For these reasons, we do not offer hypotheses regarding whether compliance is likely to be higher or lower when income is earned compared to when it is endowed.

<sup>9</sup> Thus, a key difference between taxpayers who have earned their income and taxpayers who have been endowed with income is that sunk costs are either not present or much lower in the latter situation. Consequently, reservation wages are likely to be immaterial when income is endowed.

<sup>10</sup> Interestingly, it appears that incorporating sunk cost considerations, which are irrelevant in the ASY model, actually might improve the link between predictions from theory and observed behavior. One potential explanation for this phenomenon is that the predictions from the ASY model regarding compliance responses to tax rate changes assume the taxpayers are risk-averse, and the presence of sunk costs, in the setting we examine, make decision makers more likely act in a manner consistent with risk-aversion.

## EXPERIMENTAL DESIGN

### Task Description

We designed an experiment in which two factors were manipulated between-subjects at two levels: (1) the manner in which income is obtained (earned vs. endowed), and (2) the tax rate (20 percent vs. 40 percent). The experiment was conducted in two phases: an income phase (phase 1), and a tax-reporting phase (phase 2).

In the income phase, participants were either endowed with 20,000 francs (\$20) in experimental currency, or they were required to earn 20,000 francs.<sup>11</sup> In particular, participants in the earned income condition were required to earn the 20,000 francs by spending one hour solving a series of 3-digit by 3-digit multiplication problems. Additionally, participants in this condition were informed that they would be paid 20,000 francs for their effort if and only if they: (1) worked on the multiplication problems for the entire hour or finished all 120 problems, (2) correctly solved more than 40 problems, and (3) correctly solved at least 60 percent of the problems they attempted. The instructions further indicated that anyone not meeting these criteria would be paid a default wage of 4,000 francs.<sup>12</sup> The multiplication task was chosen because, as Bonner et al. (2000) indicate, multiplication is a task that all participants would have been trained to perform in school and, consequently, lack of understanding of the task requirements should not be an issue. Further, this task is somewhat aversive for most participants and therefore is likely to engender a sense of earning income.<sup>13</sup> The performance requirements were chosen to reinforce the concept of earning income by establishing a pay-for-performance link.<sup>14</sup>

The tax-reporting phase, and the associated parameter values, were structured to be consistent with prior research (e.g., Friedland et al. 1978; Baldry 1987; Beck et al. 1991; Collins and Plumlee 1991; Moser et al. 1995; Vines and Wartick 1998; Wartick et al. 1999).<sup>15</sup> Specifically, in the tax-reporting phase, participants in both conditions decided how much of their 20,000 francs in income to report on their tax returns. In the instructions for phase 2, participants were informed that the amount of money they received at the end of the experiment would depend on how much income

<sup>11</sup> No "show-up" fees or additional payments were provided to experimental participants. Thus, the 20,000 francs was the only source of income available to participants.

<sup>12</sup> Via extensive pilot testing, the performance requirements on the multiplication task were chosen so that all individuals in the earned income condition actually received 20,000 francs.

<sup>13</sup> As a manipulation check, we asked participants to rate how hard they worked during the experiment to earn the amount of money they received. For this question, we used a seven-point scale where 1 was labeled "not very hard," 4 was labeled "somewhat hard," and 7 was labeled "very hard." The mean response in the earned (endowed) income condition was 3.68 (1.90). The income condition main effect is significant at  $p < .01$ , suggesting that our earned income manipulation was successful (the tax rate main effect and the income condition-by-tax rate interaction effect are not statistically significant;  $p > .17$  and  $p > .92$ , respectively). These results therefore suggest that while both groups of subjects likely felt that they "earned their income," this feeling was significantly more pronounced in the earned income condition.

<sup>14</sup> We used a quota-based pay scheme where all participants met the quota rather than a piece-rate pay scheme to avoid selection biases and therefore to avoid a potential threat to internal validity. There was, though, substantial variability in the number of multiplication problems correctly completed and attempted by participants in the experiment. Thus, we examined the relation between the number of multiplication problems correctly solved (or attempted) and compliance. Both simple correlations and ANOVAs indicated that there were no statistically significant relations between the number of problems correctly solved (or attempted) and compliance.

<sup>15</sup> We used explicit tax terminology in our experimental instructions to be consistent with, and enhance the comparability of our results to, the most recent experimental research examining how compliance decisions are affected by a change in the tax rate (e.g., Moser et al. 1995). We do, though, feel that the use of tax terminology is unlikely to affect our results because the average age of participants in our experiment was 21.7, and Wartick et al. (1999, 20) indicate that "subjects under 25 reported only slightly more in the tax context than in the nontax context." Additionally, our results are unaffected if participants over the age of 25 are excluded from the analysis or if AGE is included as a covariate in the ANOVAs we conduct.

they reported on their tax return and whether their tax return was audited. All participants were then informed that: (1) income reported on their tax return was subject to a 40 percent [20 percent] tax, (2) their tax return had a 25 percent chance of being selected for audit, and (3) if their tax return was selected for an audit, they would pay the tax evaded plus a penalty equal to 150 percent of the tax evaded.<sup>16</sup>

### Participants and Procedures

One hundred twenty undergraduate business and M.B.A. students from a large midwestern University participated in the experiment. Participants were randomly assigned to one of the four source-of-income and tax rate conditions, with an equal number being assigned to each condition. The earned income sessions lasted approximately one hour and 45 minutes. The endowed income sessions lasted approximately 35 minutes.<sup>17</sup> Each session consisted of a single work and/or tax-reporting task.

The earned income session began with the experimenter reading the instructions for the income phase of the experiment. Via the instructions, participants were informed that the income they earned in phase 1 would be subject to a tax in the second phase; participants were not, however, informed of the tax rate, audit probability, or penalty rate.<sup>18</sup> Following the instructions, participants worked on the multiplication exercise for one hour. At the conclusion of the hour, the experimenter verified that each participant met the performance conditions previously mentioned. The instructions for the tax-reporting phase were then distributed.

The experimenter next read aloud the instructions for the tax-reporting phase of the experiment. Participants then decided how much income to report on their tax returns. After all participants made their decisions the audit process commenced, and each participant drew a poker chip from a container holding ten red chips and thirty blue chips. Participants who drew a blue chip were not subject to an audit and their ending balance in francs consisted of: (1) the francs reported on their tax return less the tax (20 percent or 40 percent) *plus* (2) the francs not reported on their tax return. Participants who drew a red chip were subject to an audit and their ending balance in francs consisted of: (1) the francs reported on their tax return less the tax (20 percent or 40 percent) *plus* (2) the francs not reported on their tax return *minus* (3) a 20 [40] percent tax on income not reported on their tax return *minus* (4) a penalty equal to 150 percent of (3).

<sup>16</sup> All participants in a given experimental session faced the same tax rate and were explicitly informed of this fact. Moreover, no participants were informed that other sessions might utilize different tax rates. Thus, perceptions of horizontal inequity, as described and tested in Moser et al. (1995), were controlled for and therefore unlikely to exist in our study.

<sup>17</sup> We operationalized the construct "earned income" to incorporate both a significant effort and time component. For many sources of earned income (e.g., wages), both spending time at work and exerting effort on tasks are impounded in the process (or notion) of earning income. In particular, wages usually reflect the opportunity cost associated with an individual's time and effort. Accordingly, participants in the earned income condition may feel as if they have earned income because they successfully completed the multiplication task and/or because they have spent a reasonable amount of time in the experiment. For this reason, we did not wish to equalize the time spent in the two income conditions (since there is an opportunity cost associated with participants' time, this could engender a sense of earning income in the endowed income condition). Moreover, we desired as strong an earned income manipulation as possible and, as a result, both successful performance on the multiplication task and spending more time in the experiment are part of our earned income manipulation.

<sup>18</sup> We decided not to inform participants in the earned income condition of the tax rate, etc., that they would face in the second stage of the experiment to ensure that the phase 2 (tax-reporting phase) instructions were essentially equivalent across earned and endowed income conditions. That is, we wanted the tax-reporting phase of our experiment to be as similar as possible across income conditions and, therefore, that the only difference between income conditions prior to the tax-reporting phase was the manner in which income was obtained.



The procedures for the endowed income condition were similar to those described above except that this condition started with the tax-reporting phase. In particular, the instructions for this condition indicated that participants had been given 20,000 francs and that the subsequent tax-reporting decision was to be based on this endowment.

At the conclusion of the experiment, participants in all conditions were asked to complete a risk-preference instrument similar to the one used in Murnighan et al. (1988). Risk preferences were measured to determine whether there were any significant differences in attitudes toward risk across conditions. Following this, participants completed a post-experimental questionnaire which addressed (among other things) participants': (1) age, (2) gender, (3) GPA, (4) major, (5) quantitative skills, and (6) perceptions of how hard they worked in the experiment. Finally, participants converted their ending balance in francs to dollars at the rate of \$1.00 per 1,000 francs and were paid in cash.

## RESULTS

Hypothesis 1 posits that when income is endowed, participants will respond to an increase in the tax rate by reporting less taxable income. Hypothesis 2 posits that when income is earned, participants will respond to an increase in the tax rate by reporting more taxable income. Table 1 presents the descriptive statistics for reported income (in francs) by income condition and tax rate.

Notice from Table 1 that, consistent with H1, the mean, median, and modal reported income amounts in the endowed income condition are all lower when the tax rate is 40 percent than when the tax rate is 20 percent. Also notice from Table 1 that, consistent with H2, the mean, median, and modal reported income amounts in the earned income condition are all higher when the tax rate is 40 percent than when the tax rate is 20 percent. In particular, there is a 10 percent (43 percent) decrease (increase) in mean reported income when the tax rate is 40 percent compared to when it is 20 percent in the endowed (earned) income condition. This pattern of results is, as suggested by H1 and H2, indicative of an income-condition-by-tax-rate interaction effect rather than a main effect of tax rate. Figure 1 depicts this interaction.

To test H1 and H2, we ranked all of the reported income observations from smallest to largest and then applied the usual analysis of variance using these ranks as the dependent variable.<sup>19</sup> The results of this ANOVA are presented in Table 2 and indicate that the main effect of income condition is not statistically significant ( $F_{1,116} = 0.13$ ,  $p < .73$ ). Additionally, the main effect of tax rate is not statistically significant ( $F_{1,116} = 0.60$ ,  $p < .44$ ). The income-condition-by-tax-rate interaction effect, however, is statistically significant ( $F_{1,116} = 4.01$ ,  $p < .03$ ). Therefore, as predicted, the effect of an increase in the tax rate on participants' compliance decisions depends on whether income is earned or endowed. Follow-up tests (conducted by performing t-tests using the ranks) also are presented in Table 2 and indicate that in the endowed income condition, the simple effect of tax rate, although in the direction predicted by H1, is not statistically significant at conventional levels ( $t = -0.93$ ,  $p < .18$ ). The simple effect of tax rate in the earned income

<sup>19</sup> We performed an ANOVA using the ranks as the dependent variable rather than using actual reported income as the dependent variable because the reported income data for each of the four between-subjects conditions violates one of the assumptions upon which ANOVA is based. In particular, the Shapiro-Wilk test for normality indicated that the reported income levels for each of the four conditions are not normally distributed (largest  $p < .09$ ). Additionally, notice from Table 1 that the standard deviation of the reported income levels is quite high. Accordingly, an ANOVA conducted using a rank transformation of the reported income levels is likely to be more efficient (powerful) and theoretically more appropriate than an ANOVA conducted using the actual reported income levels (Conover 1980). An ANOVA conducted using actual reported income, though, yielded results that are qualitatively similar to those reported in the paper. Namely, both the tax rate main effect and the income condition main effect are not statistically significant (smallest  $p > .30$ ), while the income-condition-by-tax-rate interaction is statistically significant ( $p < .03$ ).

**TABLE 1**  
**DESCRIPTIVE STATISTICS FOR REPORTED INCOME (IN FRANCS)**  
**BY INCOME CONDITION AND TAX RATE<sup>a</sup>**

**Panel A: Endowed Income Condition**

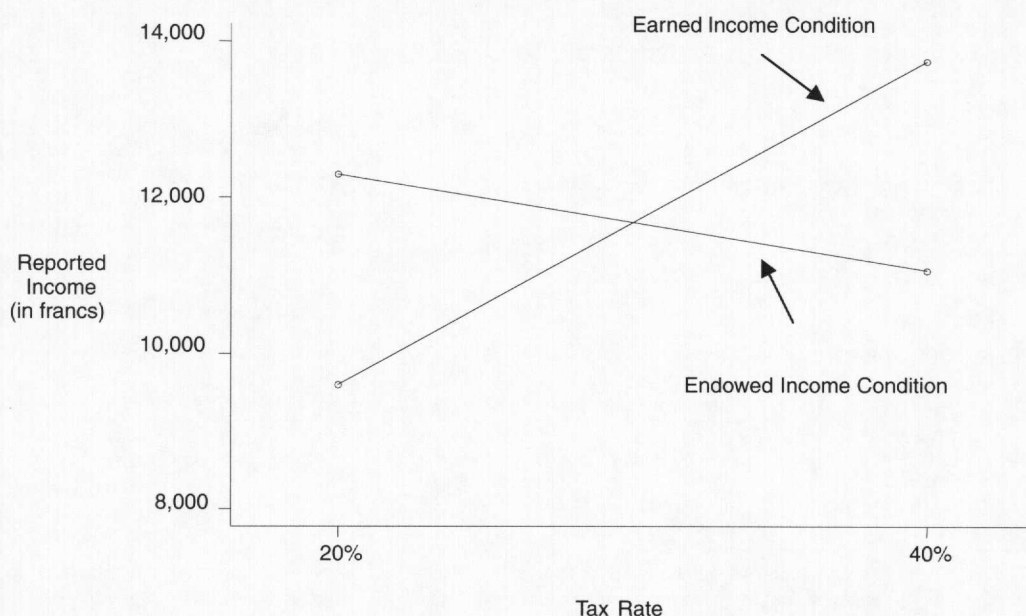
Statistic	Tax Rate		Change in Reported Income (40% - 20%)
	20%	40%	
Number of participants	30	30	—
Mean	12,300	11,060	(1,240)
Standard Deviation	7,671	6,922	—
Median	15,000	13,500	(1,500)
Mode	20,000	0	(20,000)
Minimum	0	0	0
Maximum	20,000	20,000	0

**Panel B: Earned Income Condition**

Statistic	Tax Rate		Change in Reported Income (40% - 20%)
	20%	40%	
Number of participants	30	30	—
Mean	9,600	13,740	4,140
Standard Deviation	8,681	7,208	—
Median	10,000	16,000	6,000
Mode	0	20,000	20,000
Minimum	0	0	0
Maximum	20,000	20,000	0

<sup>a</sup>The experiment consisted of an income phase and a tax-reporting phase. In the income phase, participants were either endowed with 20,000 francs (\$20) in experimental currency or they were required to earn the 20,000 francs by performing a one-hour multiplication exercise. In the tax-reporting phase, participants decided how much of their \$20 in income to report on their tax returns. In this phase of the experiment, participants faced: (1) either a 20 percent tax or a 40 percent tax on reported income, (2) a 25 percent probability of having their tax return audited, and (3) a penalty equal to 150 percent of the tax evaded if their tax return was selected for an audit.

**FIGURE 1**  
**AVERAGE REPORTED INCOME (IN FRANCS) BY INCOME CONDITION AND TAX RATE<sup>a</sup>**



<sup>a</sup>The experiment consisted of an income phase and a tax-reporting phase. In the income phase, participants were either endowed with 20,000 francs (\$20) in experimental currency or they were required to earn the 20,000 francs by performing a one-hour multiplication exercise. In the tax-reporting phase, participants decided how much of their \$20 in income to report on their tax returns. In this phase of the experiment, participants faced: (1) either a 20 percent tax or a 40 percent tax on reported income, (2) a 25 percent probability of having their tax return audited, and (3) a penalty equal to 150 percent of the tax evaded if their tax return was selected for an audit.

condition, though, is both in the direction predicted by H2 and statistically significant ( $t = 1.85$ ,  $p < .04$ ).<sup>20,21</sup>

<sup>20</sup> Additionally, the simple effect of income condition was marginally statistically significant when the tax rate was 40 percent ( $t = 1.81$ ,  $p < .08$ , two-tailed), while it was not statistically significant when the tax rate was 20 percent ( $t = -1.09$ ,  $p < .28$ , two-tailed). The higher compliance in the earned income condition than in the endowed income condition when the tax rate is 40 percent is likely the result of participants in the former condition focusing on reservation wages, and participants in the latter condition focusing on expected returns. This difference between conditions is attenuated, though, when the tax rate is 20 percent because reservation wages appear to be satisfied in both conditions (i.e., the lowest possible payoff in the 20 percent tax rate condition is \$10). Further, when reservation wages are satisfied, research (e.g., Hoffman et al. 1994) suggests that participants will behave more aggressively (i.e., behave as if they have higher target returns) when income is earned rather than endowed because earning income creates a sense of entitlement to a larger share of the surplus.

<sup>21</sup> We also collected, via a post-experimental questionnaire, certain demographic and additional information about the participants in our experiment to provide some assurance that randomization resulted in comparable treatment groups. In particular, we gathered information about each participant's age, grade point average, gender, analytic skills, and attitude toward risk. Statistical tests indicated that none of the differences in these variables across conditions were statistically significant at conventional levels (smallest  $p > .24$ ).

**TABLE 2**  
**ANALYSIS OF REPORTED INCOME**

<b>Panel A: ANOVA on Reported Income<sup>a</sup></b>					
<b>Source of Variation</b>	<b>SS</b>	<b>df</b>	<b>MS</b>	<b>F<sup>b</sup></b>	<b>p<sup>c</sup></b>
<b>Between Subjects</b>					
Income Condition <sup>d</sup>	147.41	1	147.41	0.13	<.73
Tax Rate <sup>e</sup>	691.20	1	691.20	0.60	<.44
Income Condition × Tax Rate	4,600.41	1	4,600.41	4.01	<.03
Subject(Income Condition × Tax Rate)	133,160.48	116	1,147.93		
<b>Panel B: Pairwise Comparisons<sup>f</sup></b>					
	<b>t</b>	<b>p</b>			
<b>Effect of Tax Rate<sup>g</sup></b>					
Endowed Income Condition	-0.93	.18			
Earned Income Condition	1.85	.04			
<b>Effect of Income Condition<sup>h</sup></b>					
20% Tax Rate	-1.09	.28			
40% Tax Rate	1.81	.08			

<sup>a</sup>The ANOVA was conducted using the rank of the reported income observations as the dependent variable rather than the actual reported income amounts because the actual reported income amounts in each of the four between-subjects conditions are not normally distributed.

<sup>b</sup>The Subject(Income Condition × Tax Rate) mean square is the appropriate error term for the Income Condition main effect, the Tax Rate main effect, and the Income-Condition-by-Tax-Rate interaction effect.

<sup>c</sup>Two-tailed p-values are reported for the main effect of Income Condition and the main effect of Tax Rate since there are no directional predictions for these effects. A one-tailed p-value is reported for the Income-Condition-by-Tax-Rate interaction effect given the directional prediction for this effect.

<sup>d</sup>We manipulated Income Condition as a between-subjects factor with two levels, earned and endowed. Participants were either endowed with 20,000 francs (\$20) in experimental currency or they were required to earn the 20,000 francs by performing a one-hour multiplication exercise.

<sup>e</sup>We manipulated the Tax Rate as a between-subjects factor with two levels, 20 percent and 40 percent. Participants faced either a 20 percent tax or a 40 percent tax on reported income.

<sup>f</sup>Pairwise comparisons were conducted using t-tests based on the rank of the reported income observations. Again, ranks were used rather than the actual reported income amounts because the reported income amounts are not normally distributed.

<sup>g</sup>One-tailed tests are reported given directional predictions for comparisons involving a change in the tax rate.

<sup>h</sup>Two-tailed tests are reported since there are no directional predictions for comparisons involving the effect of income condition.

To provide further insight regarding why participants made the compliance decisions they did, we asked all participants to describe (on a post-experimental questionnaire) "how they decided how much income to report/not report on their tax return." Consistent with our hypothetical development, participants in the earned income condition tended to focus on reservation wage considerations when the tax rate was 40 percent. For example, when the tax rate was 40 percent, 12 (of 30) participants in the earned income condition responded to this question by indicating an exclusive focus on reservation wage issues, with responses to the effect of "I didn't want to risk leaving the experiment with less than \$x." When the tax rate was 20 percent, however, only five (of 30) participants in the earned income condition made statements of this nature; responses tended to indicate that reservation wage concerns were satisfied and were consistent with a participant

who noted "I just took a gamble with the odds in my favor. For 1.5 hours of my time I was guaranteed at least \$10."

In the endowed income condition, again consistent with our hypothetical development, most participants indicated that a focus on expected returns guided their compliance decisions, with only five (of 60) participants across both tax rate conditions focusing exclusively on reservation wage issues. Moreover, responses in both endowed income conditions tended to echo the sentiment of one participant who noted, "seeing as I did not earn the money [i.e., work hard for it], I felt I could play the odds that I wouldn't get audited, so I reported nothing." Further, the decrease in compliance as the tax rate increased in the endowed income condition can be attributed to statements such as "I reported it all because the benefit of not reporting and possibly getting \$20 was not much greater than the benefit of reporting and getting \$16 for sure," and "the trade-off between reporting all [income] and reporting none was small, so I reported it all."<sup>22</sup>

## SUMMARY AND DISCUSSION

This study provides experimental evidence regarding the relation between tax rates and compliance and how this relation is influenced by the manner in which taxable income is obtained (earned vs. endowed). Consistent with much prior experimental evidence (e.g., Friedland et al. 1978; Baldry 1987; Alm et al. 1992; Moser et al. 1995), we find that when income is endowed, participants respond to a tax rate increase by reporting less taxable income. In contrast, when income is earned, participants respond to a tax rate increase by reporting more taxable income. This latter finding is consistent with economic theory (e.g., Allingham and Sandmo 1972; Yitzhaki 1974; Graetz et al. 1986; Reinganum and Wilde 1986; Beck and Jung 1989; Erard and Feinstein 1994) and some archival-empirical research (e.g., Feinstein 1991; see also Andreoni et al. 1998). In essence, the results of our experiment indicate that whether income is earned or endowed interacts with changes in the tax rate in determining taxpayer compliance decisions.

Our results suggest that when income is endowed, participants appear to treat their income as "house money." In this situation, participants appear to view their income as a prior gain and, consistent with research in behavioral economics (e.g., Thaler and Johnson 1990; Keasey and Moon 1996), exhibit risk-seeking behavior. That is, to offset the negative impact (on wealth) of a tax rate increase, participants, on average, report less income in what appears to be an attempt to maintain a desired expected return. On the other hand, participants in the earned income condition, particularly in the 40 percent tax rate condition, appear to focus on ensuring that they left the experiment with some minimum amount of money. That is, since participants in the earned income condition invested a considerable amount of time and effort in the experiment, they did not appear to want to risk walking away with a trivial payoff in the event that their tax return was audited. Moreover, to ensure a particular minimum "if-audited" payoff (reservation wage), one must report more taxable income when the tax rate increases.

This study makes two primary contributions. First, our results indicate that taxable income is not a fungible commodity and that individuals treat their income differently depending on the amount of time and effort required to obtain it. This finding is important because it suggests that taxpayers who exert different levels of effort to generate income may respond to changes in tax rates and other important policy variables in fundamentally different ways. Thus, changes in policy variables such as the tax rate might not only alter the amount of revenue generated by the tax system, but also might systematically alter the effectiveness, efficiency, fairness, and hence the public acceptance, of the income tax across different classes of taxpayers.

Second, our results may help reconcile seemingly conflicting prior evidence regarding how changes in the tax rate affect compliance. Specifically, prior experimental research almost uniformly

<sup>22</sup> There were, of course, responses in both income conditions that mentioned both expected value and minimum return considerations. Additionally, a number of participants mentioned that they reported all of their income on their tax return because of honesty considerations, i.e., because "it was the right thing to do" or because "whatever I earned was the right amount to report."

indicates a negative, or no, relation between tax rates and compliance, while prior archival-empirical research offers mixed results (see, Andreoni et al. 1998, 839). Our study's results suggest that these conflicting findings may be partly attributable to the fact that the manner in which income was obtained systematically differed across the two classes of studies. In prior experiments, participants were endowed with income, and our findings suggest that in this situation taxpayers will respond to a tax rate increase by reporting less income. The findings of archival-empirical studies, though, typically are based on earned income, and our findings suggest that in this case taxpayers will, consistent with economic theory, respond to a tax rate increase by reporting more income. We believe that reconciling these two bodies of work, and more generally understanding how changes in the tax rate affect compliance, is important because tax rates are a highly visible, widely mentioned, and an often adjusted policy variable (Stevenson 2000; Calmes and Murray 2000; *Wall Street Journal* 2000). Further, providing an explanation for the observed differences shows that the results obtained from experimental and archival-empirical studies are not necessarily contradictory or mutually exclusive.

The results and implications of this study should be interpreted in light of several important caveats. First, our compliance setting was very simple, and our results may not generalize to more complex settings. Future research that not only replicates our findings, but also tests the sensitivity of our findings to manipulations of wage levels, public goods provisions, government services, and policy variables other than the tax rate (e.g., penalty rates, audit rates, equity, etc.) seems warranted (e.g., Kim et al. 2000). Second, our experiments were conducted using a single income-reporting period. Allowing participants to earn income and pay taxes over multiple periods would be more consistent with the real world, and such experiments would provide important insights regarding the generalizability of our results. Third, we did not attempt to determine whether participants' compliance responses to a change in the tax rate were more attributable to the fact that a tax rate change affects the mean or the spread of the payoffs in the decision problem. Future research could investigate the compliance impact of each of these two effects. Finally, prior research has shown that individuals respond to tax rate changes by altering their mix of labor and leisure (Swenson 1988). Accordingly, taxpayers' responses to a change in the tax rate are not simply restricted to compliance-related choices, and additional research is necessary to determine whether our results hold when participants are allowed to vary both their effort and leisure choices in response to tax rate changes.

Our study's results suggest other possibilities for further inquiry. For example, it might be necessary to re-evaluate the conclusions drawn from a group of experiments that examined the impact of prior audits on compliance (e.g., Spicer and Hero 1985; Benjamini and Maital 1985; Webley 1987). In particular, the results of these experiments suggest that prior audits might effectively increase subsequent compliance (e.g., Spicer and Hero 1985, 266). In all of these experiments, though, participants were endowed with income prior to making a compliance decision and, as a result, it is possible that the effect documented might be a manifestation of the house money effect rather than a deterrence effect. That is, in the presence of *prior losses*, which result from prior audits, the house-money effect predicts increased risk-averse behavior, or hence an increase in compliance. Consequently, these experimental results may not generalize to settings in which substantial time and effort are required to generate income. In support of this, archival-empirical studies examining this issue consistently fail to document any connection between prior audits and subsequent compliance (see, e.g., Andreoni et al. 1998, 843–844).

Finally, research directed toward understanding whether and how taxpayer compliance decisions are affected by the source of earned income would be valuable. That is, do individuals exhibit different compliance behavior (1) for money earned on the job vs. interest or dividend income, (2) for physical work vs. mental work, (3) in single-person tasks vs. multiple-person tasks, (4) in strategic settings vs. nonstrategic settings, (5) in cooperative settings vs. competitive settings, and (6) in zero-sum settings vs. positive-sum settings, etc? Addressing these issues is particularly important since the results could help improve our understanding of the income sources and occupation types most susceptible to tax evasion. Moreover, insights obtained from work in this area and on these topics can be used to develop a more comprehensive understanding (descriptive theory) of taxpayer compliance behavior.

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