# BEYOND DETERRENCE: BEHAVIORAL DECISION THEORY AND TAX COMPLIANCE

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Deterrence models generally predict compliance patterns based solely on the subjective probability and utility of outcomes associated with alternative actions. Yet recent work in behavioral decision theory suggests that compliance decisions may also be affected by how the risks of noncompliance are described and how the decisionmaker's preferences are expressed. We report five experiments that examine how the cognitive heuristics evoked by these descriptive and procedural variables affect tax compliance. Using tax decision problems involving how to choose a tax professional, whether to take a questionable deduction, and how to approach an impending tax audit, we find that taxpayer preferences are significantly influenced by descriptive and procedural variables that traditional expected utility models ignore. We discuss the implications of these results for (1) extending compliance theory to understand a broader range of compliance behavior and (2) utilizing cognitive heuristics to predict the consequences of various enforcement policies.

Compliance theorists study responses by citizens and organizations to laws and legal commands. While many factors influence these responses, compliance studies in the Benthamite tradition have focused primarily on components most related to governmental enforcement policies, namely, the threat of legal sanctions. Especially since the development of expected utility (EU) theory by von Neumann and Morgenstern (1944), compliance has been analyzed using models of decisionmaking under risk and uncertainty in which the EU of the potential gains is balanced against the potential legal, social, and internalized personal sanctions from participating in illegal behavior (Becker 1968; Ehrlich 1973; Grasmick and Bursik 1990; Klepper and Nagin 1989). That is, compliance behavior is seen as an intelligent response to governmental enforcement policies that is based on the preferences of the individual.

Models based in EU have provided a widely applicable theo-

We thank workshop participants at the Department of Accountancy, University of Illinois, the editor, and three anonymous reviewers for helpful comments. Correspondence may be addressed to Jeff T. Casey, Harriman School for Management and Policy, State University of New York at Stony Brook, Stony Brook, NY 11794-3775.

LAW & SOCIETY REVIEW, Volume 25, Number 4 (1991)

retical umbrella for studying factors affecting compliance decisions.[1] However, a growing body of empirical evidence challenges the descriptive validity of the most basic assumptions that the EU approach shares with virtually all models of rational choice (e.g., Schoemaker 1982; Slovic, Lichtenstein, and Fischhoff 1988; Tversky and Kahneman 1986). For example, several authors have challenged the basic, sometimes implicit, tenet of rational choice that preferences are invariant for the same set of alternatives, regardless of the way information on alternatives is presented or the mode of expressing preference (Kahneman and Tversky 1984; Tversky, Sattath, and Slovic 1988). The *invariance principle* has two parts: *procedure invariance* and *description invariance*. Procedure invariance holds that preferences should be independent of the mode by which they are to be expressed. Thus, if one option is chosen over another, the individual should also attach a higher dollar value to the chosen option than to the alternative. Description invariance holds that preferences should be independent of the description and framing of the alternatives. The same information about alternatives should always lead to the same choice. Given the ubiquity and simplicity of these basic assumptions, it is significant that both are often violated (Tversky and Kahneman 1986; Tversky et al. 1988; Tversky, Slovic, and Kahneman 1990).

This challenge to the theory of rational choice represents an opportunity for extending compliance research. Simultaneously, because compliance behavior provides a real-world context for studying decisions under risk and uncertainty, compliance research can potentially contribute to the transformation of rational choice theory. Tax compliance provides a useful setting for this research because it is at once intuitively familiar to everyone and critically important to governance; over 100 million taxpayers file federal tax returns in the United States annually, and estimates of revenue loss due to noncompliance range between $60 and $100 billion annually (Roth, Scholz, and Witte 1989).

This article reports several experiments in the domain of tax compliance that illustrate the nature of the challenge and implications for both theory and policy. Studies 1 and 2 test the assumption of procedure invariance, while Study 3 tests the assumption of description invariance. Studies 4 and 5 extend the test of description invariance to situations with imperfect information. In each case, we describe experimental tax situations designed to strike a balance between brevity and realism, report results showing that rational models do not predict critical aspects of participants' responses, and discuss decision heuristics developed in the behavioral decisionmaking literature that provide better explanations.

[1] We will refer to the models of this genre as "rational choice models," with the caveat that behavior prescribed by rational choice models may not be universally accepted as reasonable (Rescher 1988; Shafer 1986).

We narrow our focus to simple compliance choice problems with predetermined structures that are known to the decision-maker. This allows us to clarify and clearly demonstrate the effects of specific heuristics we believe to be of particular importance to compliance theory. In our experiments there are only two options (e.g., compliance and noncompliance) and risk estimates are given for each outcome involving risk. We do not consider how choice situations evolve or how new alternatives and information are sought in the context of tax compliance (cf. Carroll 1989; Roth et al. 1989; Scholz 1985). We also acknowledge the importance of factors such as the perceived fairness of the law for compliance theory and enforcement policies (Grasmick and Bursik 1990), although we do not focus on these factors in this research.

## COMPLIANCE AS RISKY CHOICE

Our experiments begin with the conventional assumption that compliance can be analyzed in terms of the choice between two alternatives, compliance and noncompliance. In the case of taxes, consider a taxpayer who is contemplating whether or not to report $500 won in a poker game. If she reports the winnings, she will pay some part (say 25 percent or $125) of the $500 in tax. If she does not report them, she either pays no tax or she pays the tax plus penalty and interest (perhaps an additional $125) if she gets caught. The uncertainty about getting caught makes this choice risky.

In the simplest compliance model, compliance is treated as the status quo, and the taxpayer compares the advantage of noncompliance if not detected (save $125) with the disadvantage if detected (pay $125 tax plus $125 penalty and interest), after discounting each by its probability. If the probability of getting caught is 1/3, the expected value of noncompliance is: 2/3 (125) + 1/3 (−250) = 0, and thus equals the $0 (status quo) expected value of compliance. In this case, a taxpayer applying the expected value decision rule should be indifferent as to whether to comply. If the probability of getting caught exceeds 1/3, the expected value of noncompliance is negative, and the expected value model predicts compliance. If the probability of getting caught is below 1/3, the expected value of noncompliance is positive, and the model predicts noncompliance.

At least since the time of Bernoulli ([1738]/1967), analysts have noted that people do not always choose the option with the highest expected value. Economists in particular have therefore substituted the EU concept, which allows the worth or utility of a sum of money to an individual to be nonlinearly related to the monetary value. Substituting utility for monetary value provides three advantages. First, it allows for individual differences in the relative utilities associated with different outcomes. Second, it can

reflect nonmonetary concerns such as the social stigma and guilt that may be associated with illegal acts or with getting caught. Third, it can capture the generally accepted assumption that the utility gained from an additional dollar declines as wealth increases. This assumption of marginally decreasing utility, as we describe below, offers one possible explanation of the observed tendency to avoid risky options involving possible losses even when they are superior in terms of expected value. Note that the EU approach does not claim that any mental calculations take place, or even that "utility" can be measured through some unidimensional psychological scale. It does, however, assume that an individual's preferences among alternatives are consistent with a set of axioms from which EU theory is derived. Thus, choices are assumed to be made consistently, as if EU computations were taking place.

### Anomalies in Risky Choice

Experimental evidence that contradicts the rational choice perspective has provided the major impetus for the growing field of behavioral decision theory. Beginning perhaps with Edwards (1961) and stimulated by the work of Tversky and Kahneman (1974), these experiments have demonstrated that decisions made by individuals are systematically biased in comparison with predictions of EU, probability theory, and even basic notions of coherence and consistency such as the invariance principle. An extensive catalog of biases in individual judgment and decisionmaking is provided by Kahneman, Slovic, and Tversky (1982) and Hogarth (1987:216–22).

The best-known example that has been applied to compliance studies is a violation of description invariance known as the reflection effect or gain/loss framing effect. EU theory assumes that the same information will lead to the same choice. But experimental evidence has shown that framing the same alternatives in terms of gains or losses often leads to risk aversion for gains and risk seeking for losses (Kahneman and Tversky 1979; Tversky and Kahneman 1981, 1986). In other words, people are far more concerned with losses than with missed opportunities for profit, and will accept a higher risk to avoid losing what they already have than they will to gain something they do not already have.

Several analysts (Carroll 1989; Loftus 1985; Smith and Kinsey 1987) have suggested that, due to this gain/loss framing effect, taxpayers are less likely to accept the risk of cheating when they get a refund than when they end up with taxes due. Cheating to increase the size of the refund is judged less valuable than cheating to decrease the amount of the check submitted with the tax return, even when both would leave the individual with the same overall wealth. Both an experiment in the United States (Chang, Nichols, and Schultz 1987) and an international experiment in six

countries (Robben et al. 1990) have confirmed that cheating is significantly reduced for taxpayers with refunds in comparison with taxpayers with taxes due. The Robben et al. study also presented data from the United States indicating that compliance rates are highest for taxpayers getting refunds and lowest for those with taxes due, although other factors potentially affecting compliance were not controlled. Chang and Schultz (1990) controlled for income level, filing status, and other factors, and found similar results. This pattern is easily explained if taxpayers are *loss averse* (Kahneman and Tversky 1979). Loss aversion refers to heightened sensitivity to losses as compared to gains relative to the current status quo. This kind of inconsistency could be avoided if taxpayers based their compliance decisions on some net variable such as total tax liability, after tax income, or total wealth, but many taxpayers apparently do not use a net base.

These findings underscore the importance of understanding the context in which decisions are made. A tax refund tends to frame the choice in a way more favorable to compliance, suggesting that a tax-withholding policy that produces refunds for most people should increase tax compliance. In fact, most taxpayers do get refunds. However, in 1986, tax policymakers reformed the withholding system to reduce the overwithholding of taxes, since overwithholding presumably deprives taxpayers of interest income they could have if they put the overwithholding in an interest-bearing account. The experimental results suggest that policymakers may have inadvertently decreased compliance. The following sections expand on the compliance implications of taking a broader behavioral perspective on decisionmaking than the one offered by EU-based theories.

## COMPLIANCE ANOMALIES UNDER COMPLETE INFORMATION: VIOLATIONS OF THE INVARIANCE PRINCIPLE

### Procedure Invariance and Preference Reversals

The preference reversal phenomenon occurs when an individual's preferences for risky options differ consistently depending on whether they are expressed as choices between options or as judgments of how much the same options are worth in monetary terms. When offered a choice between a "safe" bet (e.g., compliance) and a "risky" bet (e.g., noncompliance) with a similar expected value, most people choose the safe bet. However, when instructed to state how much each bet is worth to them, most people put a higher price on the risky bet. This indicates a preference reversal, because the safe option is preferred in the context of choice, while the higher price implies that the risky option is preferred in the context of pricing. This is a violation of procedure invariance, since a different procedure for expressing preferences

should not change the order of preference for two options. This pattern of preference reversals has been replicated by many investigators using gambling and lottery situations, despite numerous attempts (real money payoffs, etc.) to induce consistency by motivating individuals to reveal their choices and prices honestly and accurately (Grether and Plott 1979; Slovic and Lichtenstein 1983; Tversky et al. 1990; Tversky and Thaler 1990).

We used two experimental tasks to test for preference reversal in taxpayer decisions. Both experiments will be presented before we discuss possible causes of the phenomenon. These experiments differ from previous preference reversal experiments in two ways. First, the "safe" and "risky" alternatives are placed in a tax compliance framework. Second, in Study 2, the alternatives are framed in terms of possible losses; the best possible outcome is maintenance of the status quo. While tax compliance choices often involve potential losses, previous studies of preference reversal (except Lichtenstein and Slovic 1973) have explored primarily situations involving potential gains.

We have also featured in our experiments the choices taxpayers face in selecting tax professionals, because (1) professionals are involved in half of all income tax returns (Roth et al. 1989), and (2) in providing strategic advice, professionals may affect how compliance decisions are made. For purposes of experimental clarity, we state the choice of compliance-noncompliance in starker terms than most tax professionals might. We make no claim about the morality or frequency with which such choices are explicitly offered by tax professionals.

### *Subjects and General Procedure for Studies 1–5*

Twenty-four students taking a master's level management course in statistics participated in Studies 1–4. An additional fourteen students taking undergraduate political science courses participated only in Studies 3 and 4. Thus a total of thirty-eight subjects participated in Studies 3 and 4. Problems were presented to each subject in one of two random orders. Study 5 involved a different group of subjects—seventy-one graduate and undergraduate students. All experimental problems were administered in the form of paper-and-pencil questionnaires in a classroom setting.

### *Study 1: Reversals of Preferences for Tax Professionals*

Subjects were told that they could expect a tax refund this year, but that the amount of the refund and probability of audit would depend on the aggressiveness of their accountant. Six problems were presented in random order, each involving a choice between a more aggressive and a less aggressive accountant. Accountants were identified in terms of the amount of the refund they were likely to get for the client and the probability that the

**Table 1.** Risk Estimates Provided to Subjects for the More Aggressive and Less Aggressive Accountant in Study 1

| Situation | More Aggressive | | Less Aggressive | |
|---|---|---|---|---|
| | Amount of Refund | Probability of Audit | Amount of Refund | Probability of Audit |
| 1 | $1,800 | .70 | $200 | .02 |
| 2 | 900 | .60 | 400 | .30 |
| 3 | 2,400 | .80 | 300 | .10 |
| 4 | 1,000 | .50 | 100 | .00 |
| 5 | 2,000 | .75 | 500 | .20 |
| 6 | 800 | .40 | 250 | .05 |

client would lose the entire refund as the result of an audit (i.e., due to assessment of additional tax, interest, and penalty). Less aggressive accountants offered smaller refunds and smaller audit probabilities. The amounts and probabilities for the six pairs of accountants are shown in Table 1. We anticipated that if the expected values (probability of no audit multiplied by the refund if not audited) offered by the two accountants were equal, risk aversion combined with nonmonetary incentives to comply (guilt avoidance, etc.) would result in subjects overwhelmingly choosing the less aggressive accountant. To roughly balance the overall frequency with which subjects chose each of the two accountants and to reflect the fact that expected value often favors more aggressive strategies, we assigned the more aggressive accountants higher expected values than the less aggressive accountants. (Only the probability and refund amounts, and not the expected values, were presented to subjects.)

After subjects completed the six choices, they were instructed to state, for each of the twelve accountants, the *maximum* fee (price) they would be willing to pay for the accountant's services.[2] These twelve pricing judgments were elicited one at a time in random order. The refund and probability values for each accountant were the same as in the choice problems. Subjects were instructed to state the maximum amount the accountant's services "would be worth *to you*," without regard to how much the accountant might actually charge. To discourage strategic misrepresentation (e.g., bargaining behavior), subjects were instructed to state "your 'top-dollar' price for the accountant's services, not your 'make-me-an-offer' price."

The preference reversal effect was quite strong: Choices were evenly divided between the more and less aggressive accountants, but pricing judgments heavily favored the more aggressive accountants. The results are summarized in Table 2. Subjects chose the less aggressive accountant over the more aggressive accountant

[2] Previous work has shown that the order in which subjects complete the choice and pricing tasks does not significantly affect preference reversal rates (Grether and Plott 1979).

**Table 2.** Results of Study 1: Reversals of Preferences for Tax Professionals

| | | Greater Maximum Willingness to Pay for Services | | |
|---|---|---|---|---|
| | | Less Aggressive Accountant (Low Risk) | More Aggressive Accountant (High Risk) | Total |
| Choice | Less aggressive accountant (low risk) | 15 | 50 | 65 |
| | More aggressive accountant (high risk) | 3 | 67 | 70 |
| | Total | 18 | 117 | 135 |

NOTE: Nine instances in which pricing judgments for the two accountants were tied are omitted.

in 65 of 135 (48 percent) choices, but they were willing to pay a higher fee for the less aggressive accountant in only 18 of 135 (13 percent) cases. Testing the statistical significance of this shift toward preferring the more aggressive accountant more often in pricing than in choice requires examining only instances of preference reversal (i.e., the off-diagonal cells of Table 2). Two types of preference reversal were possible: a subject could (*a*) choose the less aggressive accountant but offer a higher fee to the more aggressive accountant or (*b*) choose the more aggressive accountant but offer a higher fee to the less aggressive accountant. If observed preference reversals were due merely to carelessness or other random factors, both types of reversal should have occurred about equally often (cf. Lichtenstein and Slovic 1971). In fact, (*a*) reversals were much more common. Fifty of 53 (94 percent) of the reversals were of type (*a*). This proportion (.94) is significantly greater than the .5 chance level predicted under the null hypothesis that both types of reversal are equally likely (binomial test, $p < .01$).[3] Examining reversals on an individual basis, of the 24 subjects, 18 made more (*a*) reversals than (*b*) reversals; no subjects exhibited the opposite pattern. This proportion ($18/18 = 1.0$) is significantly greater than the .5 chance level ($p < .01$). (Six subjects made (*a*) and (*b*) reversals in equal numbers.) These tests show that more aggressive accountants were preferred significantly more often in pricing than in choice.

### *Study 2: Reversals of Audit Strategy Preferences*

Study 1 confirmed the occurrence of preference reversals in

[3] All significance tests reported are two-tailed binomial exact tests. When applied to the off-diagonal cells of a $2 \times 2$ table, this test is identical to the exact form of McNemar's test for correlated proportions (Hays 1973).

**Table 3.** Risk Estimates Provided to Subjects in Study 2

| Situation | "Up-front" Strategy | | "Stonewall" Strategy | |
|---|---|---|---|---|
| | Probability Disallowed | Amount of Tax | Probability Disallowed | Amount of Tax |
| 1 | .98 | $450 | .30 | $1,800 |
| 2 | .70 | 400 | .40 | 1,000 |
| 3 | .90 | 500 | .20 | 2,250 |
| 4 | 1.00 | 250 | .50 | 900 |
| 5 | .80 | 600 | .25 | 3,000 |
| 6 | .95 | 350 | .60 | 800 |

the tax context concerning prospective gains. The second preference reversal scenario was designed to test for reversals involving prospective *losses* in the form of additional tax, interest, and penalty due to an audit. Here, subjects were told to imagine that they were about to be audited and had consulted a tax accountant for advice on how to handle the issue of a deduction they took which later turned out to be of questionable legality. The accountant offered two strategies. The "up-front" strategy was to mention the deduction to the auditor at the outset. The "stonewall" strategy was to avoid entirely any mention of the deduction. The up-front strategy offered a large chance of a small loss in the form of additional tax, interest, and penalty resulting from the audit, thus leaving only a small chance that no additional payment would be required. The stonewall strategy offered a relatively small chance of a much larger loss but also offered a substantial chance that no additional payment would be required. Subjects made six choices between the two strategies. The loss amounts and probabilities associated with the two strategies varied across choices. These values are shown in Table 3. In an attempt to roughly balance the choice proportions for the two strategies, the up-front strategy was given a more favorable expected value in five of the six choices.[4] Subjects were later asked to state, for each of the twelve strategies, the maximum premium (price) they would be willing to pay for an "insurance policy" in which a third party (the accountant) would bear the full financial risk of the audit. As in Study 1, subjects were instructed to state their personal top-dollar price for this coverage without considering how much the accountant might actually charge.

The preference reversal phenomenon appeared even in the domain of losses, although the effect was a bit less dramatic than for the gain situation portrayed in Study 1. Subjects preferred the up-front strategy more often in pricing than in choice. The results are summarized in Table 4. Note that, in this study, the preferred

[4] This difference in expected values reflects our a priori guess that the tendency toward risk seeking in the domain of losses will slightly outweigh the tendency to comply to avoid nonmonetary consequences of noncompliance.

**Table 4.** Results of Study 2: Reversals of Audit Strategy Preferences

| | | Greater Maximum Willingness to Pay to Avoid Risk | | |
|---|---|---|---|---|
| | | Up-front Strategy (Low Risk) | Stonewall Strategy (High Risk) | Total |
| Choice | Up-front strategy (low risk) | 18 | 65 | 83 |
| | Stonewall strategy (high risk) | 2 | 40 | 42 |
| | Total | 20 | 105 | 125 |

NOTE: Nineteen instances in which pricing judgments for the two strategies were tied are omitted.

strategy in terms of pricing is the one reflecting a *lower* willingness to pay to *avoid* the risk associated with the strategy.

The up-front strategy was chosen over the stonewall strategy in 83 of 125 (66 percent) instances. However, in 105 of 125 instances (84 percent), the premium to cover the liability resulting from the stonewall strategy was higher than that to cover the liability resulting from the up-front strategy, suggesting a stronger preference for the up-front strategy in pricing than in choice. The two possible types of reversals were (*a*) choose the stonewall strategy and offer a higher price to avoid this strategy's risk or (*b*) choose the up-front strategy and offer a higher price to avoid this strategy's risk. As in Study 1, reversals occurred often and were distributed quite unevenly between the two types. Forty of the 58 (69 percent) reversals were of type (*a*). This proportion (.69) is significantly greater than the .5 chance level predicted under the null hypothesis that both types of reversal are equally likely ($p < .01$). Examining reversals on an individual basis, 16 subjects made more (*a*) reversals than (*b*) reversals, while only two showed the opposite pattern. This proportion (16/18 = .89) is significantly greater than .5 ($p < .01$). (Six subjects made (*a*) and (*b*) reversals in equal numbers.) These tests show that the up-front strategy was preferred significantly more often in pricing than in choice.

### *An Information-processing Explanation for Preference Reversals*

The preference reversals found in Studies 1 and 2 are not consistent with a traditional EU model, but psychologically based information-processing heuristics potentially explain the results. According to the *compatibility principle,* preference reversals occur because people attend more to monetary (as opposed to probability) information when setting a price than when choosing between options (Slovic, Griffin, and Tversky 1990; Tversky et al. 1990). The monetary amount to gain or lose from an option appar-

ently serves to "anchor" the pricing judgment, which is made in terms of the same monetary units. An imprecise subjective adjustment is then made to reflect the probability that this outcome will not occur. If the amount to win or lose is large and the associated probability small, the resulting adjustment does not fully reflect this small probability in the way an expected value or utility calculation would; the resulting price is too near the extreme anchor.

According to the compatibility explanation, in Study 1 the larger potential gain associated with the more aggressive accountant provided a high anchor for setting a price. The large probability of an audit and consequent low probability of obtaining this amount lead to a downward subjective adjustment in price. However, the adjustment for probability is insufficient and the resulting price is relatively near the initial anchor, leaving most of those who chose the less aggressive accountant with a higher price for the more aggressive accountant and, thus, a preference reversal.

In Study 2, where a loss was involved, the larger potential loss associated with the stonewall strategy again provided an extreme anchor and led to a willingness to pay a higher price to avoid the risk entailed by stonewalling. Consequently, those who preferred the stonewall strategy tended to behave inconsistently by being willing to pay *more* to avoid this strategy than to avoid the less preferred up-front strategy, which provided a less extreme anchor. In both studies, prices for the risky (low-probability, extreme-outcome) options were inflated relative to the prices for options having larger probabilities and less extreme outcomes (i.e., the less aggressive accountant and the up-front strategy).[5]

### *Implications of Preference Reversals for Compliance and Enforcement*

Studies 1 and 2 suggest that the use of tax professionals can

[5] A possible alternative explanation for the preference reversals observed in Studies 1 and 2 is that subjects revealed their preferences in the choice task but not in the pricing task. In the pricing task, rather than stating the maximum price they would pay for the accountant's services, subjects may have stated prices that they judged to be *fair* given the level of services to be provided by the accountant. If subjects interpreted the pricing task in this way, the observed preference reversals could not be interpreted as evidence of inconsistent preferences in pricing as compared to choice. However, there are two reasons for doubting the validity of this explanation. First, as described above, subjects were specifically instructed *not* to interpret the pricing task in this way, but instead to state the maximum amount they themselves would actually be willing to pay in the situation described. Second, numerous studies outside the tax context have confirmed the occurrence of preference reversals in the presence of real monetary consequences and incentive compatible payoff schemes within which the subject's best strategy (in the EU sense) is to reveal his or her true preference or price (see reviews by Slovic and Lichtenstein 1983; Tversky et al. 1990). Thus, preference reversals often occur even when it is clear to subjects that they may be obliged to abide by their stated preferences and prices.

change compliance rates simply by transforming compliance choices into judgments about willingness to pay a tax professional. If we compared two systems identical except for this transformation, the preference reversal effect would predict that more extreme monetary outcomes (with lower probability of occurrence) would be more important in the system involving professionals. Consider first a system in which tax liability is often underreported by a small amount that is difficult to detect but heavily punished if detected. In this system, unless the probability of detection is so small that it is ignored, the large penalties would have a greater effect on pricing than on choice. To the extent that taxpayers are aware of the differences in price and aggressiveness among tax professionals, transforming the choice of strategies into the realm of pricing and anchoring the taxpayer's judgment on high penalties should result in a higher frequency of pursuing less risky, more compliant options. Taxpayers might overpay to avoid the risk of a high penalty. The opposite would be true in a system in which the likelihood of getting caught is great but the punishment is small compared with the rewards of getting away with cheating. In this case, use of tax professionals would increase the incidence of cheating. Taxpayers might overpay for the chance of a large reward. In short, the greater the transformation of preferences from choice to the price of tax professionals, the more compliance will be increased by enforcement policies that increase the maximum penalties and reduce the greatest payoffs for noncompliance. The less the transformation, the more important are the probabilities and modal outcomes relative to extreme outcomes.

Novel procedures that take advantage of the salience of monetary information in pricing might increase enforcement productivity in other ways unrelated to tax professionals. For example, the IRS announced in 1990 that it was considering a "self-audit" in which individuals selected for audit would be notified that they were under consideration for an audit (Stinson and Vaysman 1990). The taxpayer would be given a chance to recheck his or her figures, "correct" any mistakes, pay any additional tax prior to the audit, and thus perhaps avert the audit. In essence, this method would elicit from the taxpayer a settlement "bid" that may be subject to anchoring effects. Whereas the initial judgment of how much tax to pay may have been anchored on the amount of tax saved if some income were not reported, the new judgment prompted by the IRS notification is more likely to be anchored on the large potential penalties that might result from an audit if intentional cheating were discovered. Study 1 and 2 findings suggest that this bid would typically be inflated, due to insufficient adjustment to take into account the probability that little or no penalty would result from an audit. This pattern of enforcement would not necessarily induce people to pay more than they owe, but might enhance the unduly small incentive to report income that is very

difficult to detect. An appropriate system for determining which bids to accept based on past audit experience, coupled with some random audit procedure to check on the effectiveness of the system, might increase deterrence and free auditors to concentrate on the most difficult cases.

**Test of Description Invariance: The Conjunction Effect**

Compliance choices may also be sensitive to the way in which information about probabilities of getting caught is presented. Our third experiment highlights the *conjunction effect* in which people consistently overestimate the probability of an outcome which can only occur as the result of a particular series of events (Bar-Hillel 1973; Tversky and Kahneman 1983; Yates and Carlson 1986). The conjunction effect occurs when probability information is presented separately for each event in a chain, rather than as a single, overall probability that the outcome will occur. From elementary probability theory, the conjunctive probability for a set of independent events is the product of the probabilities of the events. For example, a 50 percent chance of being audited coupled with a 70 percent chance of being penalized if audited produces a 35 percent chance of being penalized: $(.5)(.7)=.35$. As Study 3 demonstrates, people generally act as if the chance of being penalized were higher than 35 percent when the probability of being penalized is presented as the conjunction of a 50 percent chance of audit and a 70 percent chance of penalty, while, in reality, the probability is the same in both cases.

*Study 3: Conjunction Effects as Deterrents*

In this study subjects were given two different choice problems, each of which offered two alternatives. In one problem, subjects indicated which of two questionable tax shelters they would feel more comfortable utilizing. For each alternative, probability information was supplied about penalization for noncompliance. For Tax Shelter A, this probability was given as a single, holistic value (.28). For Tax Shelter B, three probabilities were given: probability of detection (.81), probability of audit given detection (.65), and probability of a penalty given audit (.53). The product of these probabilities equaled the holistic penalty probability within rounding error: $(.81)(.65)(.53)=.28$.

In the other problem, subjects were asked which of two sources of income, $1,000 of tip income or $1,000 of income earned as a child-care provider, they would choose not to report if they were going to omit one of these sources from their income tax return. The probability of penalty for not reporting tip income was given as a single value (.31). For not reporting child-care income, the information provided was the probability that the child's parent would report the child-care payments to the IRS (.75), the

**Table 5.** Results of Study 3: Conjunction Effects as Deterrents

| | | No. of Subjects Choosing Each Option | | |
|---|---|---|---|---|
| | | Option Described by Single Overall Probability Estimate | Option Described by Conjunctive Probability Estimates | Proportion of Choices Consistent with Conjunction Effect |
| Experimental Problem | Tax shelters | 23 | 10 | .70 |
| | Child care income vs. tip income | 25 | 12 | .68 |

probability that the IRS would identify a discrepancy given that the income was reported (.67), and the probability of a penalty given that a discrepancy was identified (.62). Again, the product of these three probabilities is (.75)(.67)(.62)=.31, the same as the holistic probability of a penalty for not reporting the tip income.

In both problems, subjects were given the option of expressing indifference between the two options. For example, in the child-care versus tip-income problem, subjects responded by circling either "Child-care income," "Tip income," or "Indifferent."

The results of Study 3 are shown in Table 5. For both problems, the conjunctive probability option was avoided by about two-thirds of non-indifferent subjects—23 of 33 for the first problem and 25 of 37 for the second. Both of the resulting proportions (23/33=.70 and 25/37=.68) are significantly greater than the .5 chance level ($p<.05$). (Five subjects expressed indifference for the former problem and one for the latter.) These results suggest that taxpayers who (1) think of tax enforcement outcomes as products of serial, multistage processes and (2) perceive that the probabilities of the marginal events in the enforcement sequence given noncompliance are substantial may indeed overestimate the probability of being penalized for noncompliance. The high probabilities associated with each stage of the enforcement process may tend to anchor the subjective judgment of overall probability. The subsequent downward adjustment is insufficient to reflect the fact that every event in the process must occur for a penalty to be imposed.

If an enforcement agency were to emphasize the probabilities associated with each step of the enforcement process, rather than the overall probability of punishment, these results suggest that the conjunction effect would produce heightened deterrence by focusing attention on the stages with the highest probabilities. The likelihood that tax and penalty will be imposed in an audit are dra-

matically higher than the likelihood of being audited, which is only about 1 percent overall (Roth et al. 1989). Similarly, the likelihood of getting caught for not reporting income from sources that file information reports with the IRS is quite high. Emphasizing high probability links such as these in a chain of enforcement events may overshadow the effects of very low probability occurrences elsewhere in the chain.

## COMPLIANCE ANOMALIES UNDER IMPRECISE RISK INFORMATION

We have observed that the heuristics considered in Studies 1–3 operate when point estimates or precisely defined probability distributions of outcomes are available to the decisionmaker. However, the probability of being caught and severity of penalty if caught are rarely known with any degree of precision in real-world compliance decisions. Tax researchers themselves would have considerable difficulty arriving at accurate estimates for specific cases (Roth et al. 1989). If people often deviate from predictions of rational models when they are given precise information, what will happen when they are afforded only vague or ambiguous information? Vague information may reveal new deviations from the canons of rational choice. Alternatively, people may be better adapted for dealing with the vagaries of everyday life than with the hyperprecision of the typical experimental environment. The following section considers some of the most recent research and theoretical approaches for capturing effects of imprecise probability and outcome information on decisionmaking.

### Imprecise Risk Information and Ambiguity Aversion

What happens when taxpayers know what penalties to expect but have only a vague notion about the likelihood that they will be penalized? Ellsberg (1961) was one of the first to demonstrate that individuals generally avoid ambiguity, that is, uncertainty about the probabilities of outcomes. He compared preferences for two options represented by two urns containing 100 balls each. The player chooses one of the urns, reaches in and draws a ball, and wins $100 if the ball is red. Urn 1 contains 50 red balls and 50 black balls. Urn 2 contains red and black balls in unknown proportion. No additional information of any kind is available for urn 2.

The rationally prescribed response to Ellsberg's problem is indifference. According to the principle of insufficient reason, one must assume that all possible distributions of red and black balls in urn 2 are equally likely. Averaging the number of red balls across all possible distributions yields a mean of 50. Thus, both urns offer the same probability of success. However, faced with this choice, most people avoid the ambiguous probability by choosing urn 1. Furthermore, if offered urn 2 only (or told that an urn

will be chosen *for* them), many will actually pay a premium to have urn 1 (Becker and Brownson 1964; Kahn and Sarin 1988). Ambiguity aversion gives rise to the Ellsberg paradox, which is an empirical violation of the independence principle of EU theory (Slovic and Tversky 1974).

Although aversion is the most frequent reaction to ambiguity, ambiguous options are often preferred to unambiguous ones when the probability of winning is small. Ellsberg (1961) illustrated the possibility of *ambiguity seeking* via a problem similar to the following. Suppose the urn problem is altered so that there are 1,000 balls per urn. Urn 1 now contains balls numbered 1 to 1,000. In urn 2 each ball has a number within the range 1 to 1,000, but the number of balls containing any given number is unknown. The player chooses an urn, draws a ball, and wins if the ball is numbered 687. Again, indifference is the rationally prescribed response. In this case, however, as demonstrated by Einhorn and Hogarth (1986) and Kahn and Sarin (1988), many more people prefer urn 2 than in the first example. Thus, when the probability of winning is quite small, many people seek ambiguity.

Einhorn and Hogarth (1985, 1986) developed and tested a descriptive psychological model to explain both ambiguity aversion and ambiguity seeking. According to this model, the initial probability estimate serves as an anchor for the process of estimating the subjective probability of an outcome.[6] Since the estimate is known to be imprecise, it is adjusted up or down, with the extent of adjustment determined by the individual's confidence in the initial estimate. In general, high or low probabilities are adjusted toward the middle of the probability range; high probabilities are adjusted downward and low probabilities are adjusted upward.

To clarify this model and test its application to taxpaying decisions, we conducted two studies. Study 4 illustrates the ambiguity aversion phenomenon as applied to the choice of a tax professional. Study 5 applies the Einhorn and Hogarth model directly to the deterrence issue, and extends the model to explain comparable effects that occur when the penalty amount, as well as the probability, is known only vaguely.

### *Study 4: Ambiguity Aversion in the Choice of a Tax Professional*

We examined the phenomenon of ambiguity aversion in the tax context via a tax professional selection decision. Subjects were told to suppose that, due to underwithholding, they faced a substantially larger tax payment than they had anticipated and that

[6] In later work (Hogarth and Einhorn 1990), the product of this adjustment process is assumed to be a *decision weight* (cf. Kahneman & Tversky 1979), which does not necessarily coincide with subjective probability. This decision weight, and not subjective probability, is then assumed to be used in making a decision.

they were considering two tax firms for helping them deal with this problem:

> The Firm A accountant who would do your taxes provides you with data on how he has helped past clients deal with underwithholding. Roughly *one in eight* of past clients have *avoided* paying additional tax and penalties as a result of underwithholding. The best accountant at Firm B has a past record of helping roughly *three of five* clients avoid additional tax and penalties resulting from underwithholding. However, this accountant is quite busy. He will try to do your taxes, but estimates the odds are *one in twenty* that he will have time. If he does not have time, your taxes will be done entirely by another accountant in the firm. This other accountant has helped roughly *one in ten* clients avoid additional tax and penalties resulting from underwithholding. Both firms charge about the same fee. Which firm would you choose to do your taxes?

Subjects responded by circling "Firm A," "Firm B," or "Indifferent." Note that the *expected* probability of avoiding additional tax and penalties is the same for both firms (1/8).[7] Thus, there is no rational basis in probability theory or EU theory for preferring one firm over the other. Nonetheless, significantly more than 50 percent of subjects—18 of 25—avoided the ambiguous probability by choosing Firm A to do their taxes ($p < .05$), demonstrating ambiguity aversion in taxpaying decisions. (The remaining 13 subjects expressed indifference between the two firms.)

*Study 5: Effects of Vague Probability and Penalty Information*

Since most taxpayers have only vague information about the likely *penalty* as well as the probability of getting caught, we designed an experiment to test and compare on equal footing the impact of vagueness along both dimensions on taxpayer decisions. The results indicate that both dimensions are affected in the same way. The following is an abbreviation of the scenario provided to subjects at the beginning of the experiment:[8]

> You expected to break even on last year's taxes, but discover in the course of completing your tax return that you will have to pay $1,000. You consult a tax accountant who tells you the following. There is a deduction you can take which would offset the $1,000 payment. However, while most accountants believe the deduction is perfectly legal, the IRS began disallowing it last year. Further, the IRS spot-checks anywhere from 0 to 100 percent of returns for deductions of this type and, if you take the deduction and your return is among those screened, you will have to pay the $1,000 plus possible interest and penalty. Your total payment could be anywhere from $1,000 to a maximum of

[7] Firm A: 1/8; Firm B: $(3/5)(1/20)+(1/10)(19/20)=1/8$.

[8] For a more detailed description of this study, see Casey and Scholz (1991).

> $3,000. The accountant investigates further and provides you with the following information [which varied across experimental problems]: "I am *very unsure* about how likely it is that your return will be spot-checked. I am hesitant even to make a guess, but if you insist, I would guess that if you take the deduction you will have a 10 percent chance of having your return spot-checked. I am also *very unsure* about how much you will have to pay. Again, I'm hesitant even to make a guess, but if you insist, I would guess that you will have to pay a total of $2,000 in tax, interest, and penalty." Would you take the deduction?

The subjects were instructed to mark a nine-point scale anchored at left by "strongly prefer not to take deduction," at right by "strongly prefer to take deduction," and at its midpoint by "indifferent." Four major factors were varied in hypothetical situations presented to each subject; probability of deduction being disallowed, penalty if disallowed, vagueness of the probability estimate, and vagueness of the penalty estimate. To provide a full range of deterrence possibilities, probability levels of .1, .5 and .9 and penalty levels of −$1,200, −$2,000, and −$2,800 were included and combined to form nine probability-penalty combinations. For each probability-penalty combination, four levels of informational precision were created by describing the probability estimate and penalty estimate independently as either vague (as in the above vignette) or precise. It was emphasized to subjects that the total payment if detected would never be less than $1,000 nor more than $3,000. This information provided boundaries for the penalty dimension comparable to the natural 0,1 boundaries for the probability dimension.

*Boundary effects.* As deterrence models predict, the preference for noncompliance in the experiment increased as the probability of detection and the penalty decreased, regardless of the vagueness of information. However, when probability information was made vague and probability was near the upper and lower boundaries of the probability dimension, preferences changed in opposite directions, as predicted by the Einhorn and Hogarth model. That is, vagueness made noncompliance less attractive when the probability of detection was given as .1, but vagueness made noncompliance more attractive when the probability was given as .9. One intuitive way of understanding this reversal is that individuals exhibit *boundary effects* by tending to move away from extreme estimates (near the scale boundaries) when information becomes unreliable. Thus, although the effects at the opposite boundaries may be asymmetric, individuals generally treat low but vague probabilities (e.g, .1) as if they were somewhat higher, and high but vague probabilities (e.g, .9) as if they were somewhat lower. Consider first the low probability case. The subjective probability (or decision weight) of detection in the vague information case would be greater than in the precise information case,

making the questionable deduction less attractive. In the high probability case, vagueness leads to a lower subjective probability and consequently a stronger preference for taking the deduction.

A strikingly similar pattern of results emerged for different levels of *penalty* when information on the penalty dimension was made vague. As with probability, when penalty estimates were vague, penalties close to the boundaries of the penalty range were treated as if they were nearer the middle of the scale. The effect of vagueness of penalty information was to increase the preference for taking the deduction when the penalty estimate was high ($2,800) but to reduce the preference for the deduction when the penalty estimate was low ($1,200). All effects were significant using both analysis of variance and multiple regression tests.

### Implications of Boundary Effects for Compliance and Enforcement

What would happen to actual levels of compliance if information about the probability of detection and penalty became more vague? EU-based theories of deterrence are of limited help in addressing this question. Boundary effects are not predicted by EU, because EU ignores vagueness in probability estimates and translates outcome estimate vagueness into risk. This leads to the prediction that probability vagueness is inconsequential and the effect of penalty vagueness should depend solely on risk attitude. According to our experimental results, increasing vagueness would increase compliance at low probabilities and penalties, since preference for the compliance option becomes stronger as vagueness increases. This result has been confirmed in other experiments as well (e.g., Alm, Jackson, and McKee 1990). However, if the probabilities of detection and penalties are large, as with income and other tax items that are reported to the IRS by third parties, compliance would *decrease* as vagueness increases. In short, greater confusion about detection activities would lead to more compliance in situations where deterrence is relatively weak, but to less compliance where deterrence is strong.

One policy implication is that enforcement officials can increase compliance if they provide clear information about detection probabilities for situations where detection rates and penalties are high (relative to known statutory limits) but do not offer clear signals about low detection rates and low penalties. However, agencies can seldom control such information, particularly when professionals such as tax practitioners can gather information over a large number of cases. Furthermore, a policy of varying penalties for a given noncompliant act in order to enhance ambiguity would conflict with established principles of jurisprudence calling for equal treatment for equal crimes.

Tax enforcement officials can, however, design strategies to provide for variance in the probability of getting caught. Recall

that the average yearly chance of being audited is now about 1 percent. If the same audit resources were concentrated in different geographic locations and on different occupations each year, audit probabilities could be raised to any number, say, 10 percent, in some randomly determined segments each year. Thus the audit probability would be less than 1 percent for many areas but 10 percent for others. If the behavior observed in our experiments generalizes to actual taxpaying decisions, adding ambiguity to assessments of audit chances would increase compliance.[9]

## DISCUSSION

Consistent with the deterrence tradition, we have represented the compliance problem from the taxpayer's viewpoint as a choice between options of varying degrees of riskiness, where money is the key outcome dimension. However, we have broken from tradition by focusing on the cognitive processes and strategies people use for subjectively evaluating and choosing among risks. Following a basic approach in the field of behavioral decision theory, we began with the simplest possible representation of risky options, identified behavioral anomalies and underlying cognitive processes, developed prescriptive implications, and then relaxed assumptions about perfect information to more nearly reflect typical real-world decisions.

The explanatory power of basic decision process models demonstrated in these studies suggests that further applications of behavioral decision theory to compliance behavior are warranted. We have identified several behavioral phenomena that are inconsistent with rational maximizing models of deterrence but that potentially affect compliance. The present studies suggest that taxpayers' decisions are sensitive to how risk information is presented and how preferences are expressed. When risks of noncompliance are known to the taxpayer, the preference reversal phenomenon suggests that the way preferences are expressed (e.g., whether a tax professional is used) can affect compliance decisions by altering the relative weight placed on the probability of detection versus the penalty if detected. The conjunction effect suggests that compliance can be enhanced by providing probability information for individual, high probability links in the enforcement chain. Ambiguity and vagueness effects suggest that compliance decisions are affected by the degree of imprecision in estimates of the probability of detection. Similar effects may occur for penalty estimates. However, boundary effects demonstrate that whether vagueness about risks increases or decreases compliance may de-

[9] Politically, this strategy would have to be justified in terms of high noncompliance rates among the groups targeted in a given year for intensive audit coverage. Furthermore, the strategy would have to be sufficiently random to ensure that groups targeted in the past would have a positive probability of being chosen again.

pend critically on where the risk estimates fall within the range of possible values.

One difficulty with developing a compliance model based on the set of phenomena we have described is that, in many situations, multiple phenomena may plausibly exert influence, sometimes in opposite directions. A general theory of behavioral decisionmaking does not yet exist that integrates the range of newly discovered effects and explains their interaction. Until theory provides a more adequate solution, an empirical "tournament of biases" may be one useful way to study the interactions and relative importance of different effects on rates of compliance in different settings.

A further difficulty arises in moving from laboratory experiments to policy decisions. Our policy examples are meant to illustrate the potential usefulness of behavioral decision theory in administrative settings and stimulate policy innovations. But laboratory experiments are intentionally designed to magnify the effects under investigation and minimize the complexities that affect decisionmakers outside the laboratory. To extrapolate from laboratory findings to policymaking would be premature without field research, particularly field experiments to ensure that conditions simulated in the laboratory adequately reflect the relevant features of tax decisions (Boruch 1989).

We view our studies as providing the necessary, but not sufficient, condition for applying the results from laboratory experiments in behavioral decision theory to the understanding of compliance. Experiments provide an efficient means for clarifying concepts and demonstrating causal relationships, which gives them great potential to complement survey and field studies in the quest for a parsimonious but accurate model of the compliance decision process. Field research is required to test the usefulness of behavioral concepts in explaining compliance behavior outside the laboratory.

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