THE SHADOW PRICE OF MORALITY

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INTRODUCTION

The pre-classical and classical economists were primarily moral philosophers whose writings were infused with discussions of ethical subjects—witness Adam Smith's *Theory of Moral Sentiments*. But moral issues generally fell out of vogue among the neoclassical economists of the 20th century, as the profession strove to emulate the natural sciences by emphasizing mathematical models of measurable phenomena. Only recently has morality resurfaced as a topic of formal economic inquiry, subject to modern tools of analysis.[1]

There is already some evidence that morality enters the decision-making processes of most individuals in some way. This helps to explain why people generally obey civil laws, religious and ethical codes, and other social norms despite risk-adjusted inducements to the contrary. As a review of the literature shows, however, no satisfactory measure of morality has yet been introduced. The present paper is therefore an initial, context-specific attempt to define, model, and measure the shadow price of morality. Broadly speaking, this concept represents the value that an individual places on his or her own adherence to ethical standards of conduct.

Like all shadow prices, however, the value of morality is not directly observable; nor is it likely to be the same in all circumstances. Thus, to make the concept tractable, we develop it in the context of an income tax compliance problem, where the shadow price of morality measures the value of one's own honesty—or equivalently, the psychic tax that an individual places on his or her own dishonesty—in a specific financial matter. Data from an income tax experiment are then used to impute the value of morality. Among the participants in this experiment, the average shadow price lies within a fairly narrow range, acting as a psychic tax on undeclared income at rates near 15 percent.

ECONOMIC VIEWS OF MORALITY

Before examining economic models of morality, it should be noted that terminology has not been uniform or even consistent within this literature. Morality, for example, has been variously identified—and even used synonymously—with ethics, virtue, a conscience, a feeling of guilt over wrongdoing, honesty, altruism, willingness to cooperate, fairness, a sense of duty, and social responsibility. For present purposes, it will suffice to consider morality to be an internal preference parameter, distinct from risk aversion, that encourages adherence to ethical standards of conduct. That is,

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one's inner sense of right and wrong, which may manifest itself in feelings of self-esteem when one behaves in accordance with it, and in feelings of remorse when one acts in violation of it. Moreover, the term "shame" has also been used inconsistently in economic analyses. Some authors regard shame as a private feeling of guilt over wrongdoing [Grasmick and Bursick, 1990], while others use the term to denote public humiliation or disgrace [Erard and Feinstein, 1994]. The distinction is important, so to prevent semantic confusion, we will avoid this term in the discussion that follows, adopting instead the (hopefully) less ambiguous terms "remorse" and "disgrace" for being ashamed of one's self and incurring the scorn of others, respectively.

Recent economic discussions of morality have typically been conducted in rather broad terms, critiquing the neoclassical view of man as a rational but amoral maximizer of expected utility. These criticisms are generally based on evidence that individual optimizing behavior is often tempered by personal values other than self-interest. For example, studies of game-theoretic decisions such as the prisoner's dilemma, ultimatum games, and dictator games have repeatedly shown instances of cooperation and reciprocity despite incentives to behave selfishly [Sen, 1988; Henrich et al., 2001; Konow, 2000; Ben-Ner et al., 2004]. As a consequence, some observers have argued that the neoclassical paradigm should be abandoned or radically altered; Etzioni [1986], for example, favors a multiple-utility framework to account for pleasure and morality separately. Others, such as Brennan [1989] and Isaac [1997], would modify the standard assumptions only slightly so as to include some moral or ethical parameter in the utility maximization problem. The present paper is in the spirit of the latter.

Despite the growing recognition that morality matters in economic decision-making, however, there have been relatively few attempts to formally incorporate non-selfish values into the conventional framework in a tractable way. Not surprisingly, most authors undertaking this task have proposed some form of monetary standard to gauge the importance of morality. Reder [1979], for example, suggests the wealth that one would willingly forego to avoid defaulting on an unsecured loan or other contractual obligation as a measure of morality, but offers no advice on estimating such a measure in practice. Frank [1996] uses labor market data to show that individuals demand a wage premium (accept a wage discount) to work at jobs with low (high) levels of social responsibility, and interprets this compensating wage differential as the price of the "moral high ground". While this is an important advance, the degree of social responsibility in any particular industry or occupation is necessarily subjective, so it is difficult to interpret the wage premium as either an average or marginal price per unit.

Another economic phenomenon that has been proposed as a vehicle for examining morality, and the one we shall pursue here, is income tax compliance.[2] In the original model of tax evasion constructed by Alligham and Sandmo [1972], compliance was based primarily on legal sanctions and risk aversion. In one version of their model, a reputation cost, or the stigmatizing effect of being publicly disgraced or demeaned in the eyes of one's social peers, was also proposed as a deterrent to tax evasion, though morality *per se* was not; and later writers including Yitzhaki [1974] and Yaniv [1994] have often dropped reputation costs from their extensions of the model in order to

focus more clearly on fiscal parameters and risk aversion.[3] Based on those theoretical analyses and subsequent empirical work, it is now widely agreed that the tax rate, the audit probability, and the penalty for evasion are important determinants of compliance for two reasons. First, a tax rate that exceeds the expected penalty rate on undeclared income provides a financial incentive for evasion.[4] At the same time, however, the uncertainty of an audit makes undeclared income risky in comparison with declared income. Thus, aversion to risk is also of central importance, as the individual's preference for security conditions his or her response to the uncertainty of being audited.

But empirical studies frequently report less tax evasion than would be expected from amoral opportunists, given the risk-adjusted financial incentives for evasion. As Andreoni, Erard and Feinstein [1998, 855] observe, "The most significant discrepancy that has been documented between the standard economic model of compliance and real-world compliance behavior is that the theoretical model greatly over-predicts noncompliance." This suggests that taxpayer behavior may be influenced by moral preferences or other non-avaricious motives traditionally absent from expected utility theory.

A few attempts have been made to extend the model to include such motives, but where morality is concerned, these have been largely inconsistent with each other. In one such study, Benjamini and Maital [1985, 246] model what they call "social stigma, or fear of apprehension," presumably to capture the reputation cost proposed by Allingham and Sandmo [1972]. But the constant level of disutility that Benjamini and Maital [1985] associate with this social stigma appears to be unconditional—it occurs regardless of whether an evader is caught. This would seemingly make the disutility of evasion that they discuss a matter of morality rather than a matter of reputation or social stigma. But by imposing a fixed utility cost on evaders, their model fails to distinguish between large and small amounts of evasion; it describes, in essence, an all-or-nothing form of morality.

In contrast, Cowell [1990] essentially sidesteps moral preferences altogether. In a chapter entitled "Morality and Community" Cowell [1990] replaces morality with the avoidance of public disgrace, thereby effectively nullifying any inherent ethos. In his words,

> If we are to assign a role to "social conscience" in influencing economic behavior, then we had better specify a lever by which that influence is exerted. Virtue for its own sake is laudable, but it is unexciting in terms of economic content. Instead we shall suppose that the individual taxpayer is no more inclined to innate goodness than he was in [the basic model]; but he does respond to penalties, and just as the state can impose legal penalties in the form of surcharges and fines, society can impose on the exposed malefactor the penalty of disgrace. It is the potential stigma that such exposure would produce that acts as the lever [Cowell, 1990, 108].[5]

Taking a different approach, Erard and Feinstein [1994] attempt to distinguish between the effect of a guilty conscience and the effect of public disgrace. However, in

their model, a guilty conscience is curiously conditional: it operates only if a tax evader escapes detection. If instead, (s)he is exposed, the individual is subject to a financial penalty and the embarrassment of social stigma, but his or her conscience is evidently clear. This psychological dependence on the state of nature is problematic; for what is commonly understood to be a moral sentiment is state-independent. That is, one who recognizes his or her own action to be immoral (and not merely socially unacceptable) feels remorse regardless of whether (s)he is caught. When detection occurs, legal sanctions and public humiliation may be experienced in addition to feelings of remorse, but the former do not displace the latter, as pointed out by Gordon [1989].[6] Indeed, the remorse and disgrace parameters enter the Erard-Feinstein model in a rather ad hoc fashion, and consequently, the magnitudes of their coefficients are difficult to interpret.

Moreover, Erard and Feinstein [1994] disregard the effect of risk by imposing risk neutrality on each individual in their empirical analysis. As a result, any deterrent effect of risk aversion is captured by the inflated effects of remorse and disgrace, which are nevertheless significant only in some heavily constrained specifications. The disgrace term is especially likely to be inflated, since remorse was assumed to be absent if disgrace was present. This conclusion is strengthened by the findings of Grasmick and Bursik [1990], which show that disgrace, while important for other offenses, is not a statistically significant deterrent to tax evasion. This is probably because tax evasion is often a strictly private matter: in many cases, an evader can be audited, discovered, and fined without being publicly exposed to his or her peers. Indeed, Cho, Linn, and Nakibullah [1996] find it optimal for the taxing agency to privately renegotiate penalties, allowing evaders to avoid the public disgrace associated with bankruptcy.[7]

In addition to the issues raised above, myriad other variables have been proposed as potential determinants of taxpayer behavior, and identifying the causes of evasion has become the subject of a large literature; see, for example, the reviews by Jackson and Milliron [1986] and Andreoni, Erard, and Feinstein [1998]. But many of these potential factors are controversial because they lack a theoretical basis. As Webley et al. [1991, 22] note, "demographic variables, like sex, age, and social class…consistently predict evasion. But it is rare indeed to come across explanations of why such demographics are relevant, and their inclusion seems to be more a matter of measurement convenience" than modeling accuracy. Perhaps the likeliest explanation is that demographic factors influence an individual's aversion to risk [Halek and Eisenhauer, 2001], and are thus already subsumed in the basic model.[8] Other potential compliance factors lack empirical support. It has been argued, for example, that perceived inequities in the tax code—both horizontal and vertical—can encourage evasion by those who believe they are being treated unfairly in comparison with others. But Mason and Calvin [1978] found no significant effects of tax equity on behavior, and Engelbrecht et al. [1998] likewise found fairness to be insignificant in most cases. Similarly, Kaplan and Reckers [1985, 102] found that individuals' judgments concerning evasion were not influenced by the fairness of the tax system, and concluded, "These results suggest that beliefs about fairness are not as important as beliefs about the morality of cheating."[9]

The model below seeks to improve upon this prior research by introducing morality into the conventional framework in a manner that is at once simple and sensible, as well as analytically and empirically tractable. To that end, pecuniary incentives,

risk, aversion to risk, and morality are explicitly modeled, while other potential factors, including disgrace, fiscal complexity, and fairness are excluded. Even if there were agreement that these latter factors play a role in practice, their exclusion from the current study should not distort our parameter estimates, because the data come from an experiment in which these factors are not present to any noticeable degree. For example, because the income endowments are single-sourced and the simulated tax payment procedure is far simpler than the filing of actual income tax forms and the associated record keeping, complexity should not discourage compliance in the present study. Similarly, the simple, proportional tax rates used in the experiment make perceptions of inequity unlikely. And while the experiment incorporates financial penalties for evasion, there is no public disclosure that would disgrace or stigmatize evaders, and thereby serve as a deterrent.

THE SHADOW PRICE OF MORALITY: AN EXPECTED UTILITY MODEL

Consider a risk-averse individual with a concave, twice-differentiable von Neumann-Morgenstern utility function U, such that $U' > 0 > U''$. The individual is endowed with exogenous income of Y, and is obligated to pay a tax (at a rate denoted by t) on declared income (YD). There is a probability p of being audited by the fiscal authorities, and if tax evasion ($YD < Y$) is detected, undeclared income is fined at a rate of f, where $f \geq t$. So far, this is the standard model of Allingham and Sandmo [1972]. But now suppose that undeclared income bothers (one is tempted to say "taxes") the individual's conscience, and thereby reduces the utility (s)he derives from undeclared income, regardless of whether or not it is detected. Then expected utility is given by

$$EU = (1-p)U(Y - tYD - \lambda(Y - YD)) + pU(Y - tYD - f(Y - YD) - \lambda(Y - YD)) \tag{1}$$

where λ denotes the psychic cost of remorse over one's own dishonesty, or more simply put, the monetary value of honesty. Inasmuch as it is an unobservable deterrent to illicit or unethical behavior, we shall refer to this parameter as the shadow price of morality.[10]

The individual decides how much income to report to the taxing authority so as to maximize expected utility. For an interior solution, the optimal level of declared income (YD^*) is defined by the first-order equation

$$(1-p)(t-\lambda)U'(Y - tYD^* - \lambda(Y - YD^*)) = p(f + \lambda - t)U'(Y - tYD^* - (f + \lambda)(Y - YD^*)) \tag{2}$$

and the second-order condition is easily shown to hold.[11] Note that expected income, net of actual and psychic taxes as well as expected penalties, is

$$EI = Y - tYD^* - \lambda(Y - YD^*) - pf(Y - YD^*). \tag{3}$$

From equation (2), a Taylor-series expansion of marginal utility around *EI* yields

$$(4)\qquad \begin{aligned}&(1-p)(t-\lambda)U'(EI)+(1-p)(t-\lambda)pf(Y-YD^*)U''(EI)\\&=p(f+\lambda-t)U'(EI)+p(f+\lambda-t)f(p-1)(Y-YD^*)U''(EI)\end{aligned}$$

which can be rearranged to give

$$(5)\qquad Y-YD^*=[t-pf-\lambda]/[Ap(1-p)f^2]$$

where $A=-U''(EI)/U'(EI)$ is the Pratt-Arrow measure of absolute risk aversion, evaluated at the optimum.[12] Notice that *t-pf* represents the average financial cost, and *t-pf-*λ denotes the average overall (financial and psychological) cost of tax compliance, or the average gain from one dollar of tax evasion. The risk involved in tax evasion is captured by the variance of the legal penalty; this is given by $\sigma^2=(1-p)(0-pf)^2+p(f-pf)^2=p(1-p)f^2$, which appears in the denominator of equation (5). Thus, equation (5) defines optimal evasion (*Y-YD**) in terms of a mean-variance analysis, or equivalently, a risk-benefit analysis, with the mean benefit of evasion being reduced by the shadow price of morality. From a more philosophical perspective, equation (5) can be interpreted as implying that morality is one of the factors separating sin ($Y-YD^*$) from temptation ($t-pf$).

The comparative statics associated with equation (5) are both obvious and intuitive. Evasion increases with the expected cost of compliance, declines with both risk and risk aversion, and declines as well with morality. If one wishes to isolate the separate effects of *t*, *p*, and *f*, then holding absolute risk aversion constant, evasion can be seen to rise with the tax rate, and fall with both the probability and severity of punishment.[13] In purely financial terms, tax evasion is a gamble with a positive expected value: in virtually every taxing jurisdiction, the fiscal parameters are such that $t>pf$. But as Baldry [1987, 377] suggests, "Some subjects…incur a 'moral cost' when they cheat, and this cost must be set against the pecuniary gains available from cheating. If the costs exceed the gains, cheating does not take place." In particular, note that with $A>0$ and $\lambda<t-pf$, some degree of tax evasion is optimal, whereas for $\lambda\geq t-pf$, a corner solution obtains in which full compliance with the tax code is optimal. Indeed, this formulation does not imply that everyone has a price at which (s)he would act immorally; for $\lambda\geq 1$, a dollar of illegitimately obtained income would provide no positive utility, so full compliance would be optimal (for either a risk averter or a risk neutral individual) regardless of the magnitudes of the fiscal parameters.[14]

Of course, it is not necessary that $\lambda>0$; $\lambda=0$ and $\lambda<0$ are also possible.[15] It is tempting to identify these conditions as morality, amorality, and immorality, respectively. But some observers may object to such language on philosophical grounds, arguing that any evasion is immoral, and thus a moral tax evader is an oxymoron. From that

perspective, morality, judged by behavioral outcomes, is a dichotomous, all-or-nothing state. (For a model of this sort, see Dowell, Goldfarb, and Griffith [1998]). Without denying the validity of that perspective for some purposes, it seems reasonable to assert that not all immoral acts are equally bad (nor are all moral deeds equally good). Most people would not equate petty larceny (stealing a loaf of bread, for example) with grand theft larceny (stealing an automobile); though both may be deemed immoral, *ceteris paribus*, the former is arguably less immoral and may thus evoke less remorse (a lower value of λ) than the latter. Hence, the present work investigates a more fundamental question: Is a moral preference operative, and if so, can its magnitude be measured in a meaningful way? To address these issues, we now turn to the experimental estimation.

MEASURING MORALITY: AN EXPERIMENTAL ESTIMATION

Though it is possible to estimate tax evasion at the individual level by using direct survey methods [McCrohan, 1982], the inherently clandestine nature of the activity generally impedes truthful disclosure.[16] A number of researchers have therefore used samples of actual tax returns to investigate evasion (see for example Clotfelter [1983], Dubin, Graetz, and Wilde [1987], Klepper and Nagin [1989], and Slemrod [1985]). But perhaps the most common method of studying evasion has been experimental simulation.[17] While the experimental method has obvious limitations (some of which are discussed below), its widespread use suggests that the advantages outweigh the disadvantages. One advantage is the ability to introduce a temporal aspect (albeit a somewhat artificial one) into the data by simulating the lapse of time. And the most compelling benefit may be the controlled environment in which decisions are made: extraneous and distracting aspects of the problem that inevitably arise in practice—such as the complexity of the tax code—can be removed in order to focus attention on the central issues. The present model is therefore estimated with data from an experiment conducted at the Laboratory for Economics and Psychology at the University of Colorado at Boulder by Alm, Jackson, and McKee [1992a; 1992b]; see the appendix in Alm, Jackson and McKee [1992a] for the experimental instructions.

Fifteen undergraduate student volunteers were initially endowed with wealth consisting of ten monetary tokens each, and then, in three groups of five, randomly assigned incomes ranging from 2 to 3 tokens in increments of .25, during each of 25 rounds, or periods. Knowing the tax rate, the probability of an audit, and the penalty rate, the subjects were required to declare an income and pay tax on the reported amount in each period. Subjects were randomly selected for audits by the use of a bingo cage; those who were audited and found to have evaded taxes were assessed the stated fine. All income endowments, tax payments, and fines were recorded via computer, and at the end of each such session, the tokens were redeemed for cash. A total of seven such sessions were conducted, each with different volunteers and different values for the fiscal parameters, yielding 105 subjects and 2,625 observations in all. The tax rate varied from 10 to 50 percent, the audit probability ranged from 2 to 6 percent, and the penalty rate varied from 20 to 100 percent of undeclared income.

These calibrations were intended to approximate realistic fiscal parameters facing actual taxpayers.[18]

Compliance rates—the ratios of declared income to endowed income—ranged from zero to 100 percent, though only 2 of the 105 subjects complied fully with the tax obligation in every round they faced; all other subjects engaged in some degree of tax evasion. The average compliance rate overall was approximately 1/3. This is consistent with actual compliance rates in the U.S. for rents, royalties, partnerships, and other income that is not subject to source withholding. Klepper and Nagin [1989] found such rates using Internal Revenue Service audit data, and more recently, Feldman and Slemrod [2003] obtained similar estimates from unaudited tax returns.

This parallel with empirical outcomes suggests that the financial incentive to under-report income is a strong inducement where the opportunity (lack of withholding) exists. Another possible explanation for the low compliance rates in the experiment is the absence of a public good in these seven sessions. Because the tax revenue was essentially discarded, there may have been less incentive to pay taxes than would have existed if each subject had perceived benefits to him- or herself and others. Thus, in an eighth session, the experiment was modified to include a public good in the form of a transfer payment: a fund equal to twice the collected tax revenue in each group was redistributed evenly among the five members of the group.[19] There was no statistically significant difference, however, in the mean compliance rates between the session with the public good and those without it. In addition, because the provision of the public good in the final session altered the nature of the decision process by requiring each participant to anticipate the aggregate behavior of the others in his or her group, the data points in that session were not independent of one another and were not strictly compatible with the theoretical model. That session was consequently excluded from the primary analysis, though replications that included the final session and a dummy variable to control for the existence of the public good yielded virtually identical results. The absence of the public good in the current study also removes personal gain as a potential motive for paying the tax, and allows us to focus more clearly on risk aversion and morality as the motives for compliance.[20] An interesting and more realistic future extension of this work would include public goods throughout the entire experiment and adapt the model and empirical methodology to accommodate them.

Alm, Jackson, and McKee [1992b] used the experiment outlined above to observe the effects of the exogenous fiscal parameters on compliance. In contrast, the present analysis uses the compliance data to elicit explicit information regarding preferences; in particular, to obtain point and interval estimates of risk aversion and the shadow price of morality. To recover the preference parameters A and λ, we transform equation (5) into

$$\sigma^2(Y - YD^*) = [-\lambda / A] + [(t - pf) / A], \tag{6}$$

which is suitable for regression as

$$\sigma^2(Y - YD^*) = \beta_0 + \beta_1(t - pf). \tag{7}$$

The dependent variable is therefore unreported income weighted by risk, and the independent variable is the expected rate of financial gain from tax evasion.[21] Estimation of the slope then gives absolute risk aversion as

$$A=1 / \hat{\beta}_1 \tag{8}$$

and the shadow price of morality is obtained from the estimated slope and intercept as

$$\lambda = -\hat{\beta}_0 / \hat{\beta}_1. \tag{9}$$

Ideally, a separate regression would have been run for each individual. But because each subject participated in only one session with a given fiscal regime and therefore faced no variability in the fiscal parameters comprising the independent variable, individual regressions were not feasible. The regression indicated by equation (7) was therefore run by income group: a separate regression was run for each level of income in the experiment, and a final regression was run using all 2,625 observations. This procedure allows us to first examine results separately by income quintile and then to obtain more aggregate, overall results.

Because instances of full compliance ($YD^* = Y$) resulted in a lower bound of zero for the dependent variable, Tobit regressions were used to address data censoring. The results, however, were quite robust to alternative estimation methods; ordinary least squares regressions in particular yielded very similar parameter estimates.

Descriptive statistics are shown for each of the five income levels (or quintiles) in Table 1, with the final column representing the entire data set. Among the 525 individuals receiving the smallest endowment (2 tokens), for example, declared income averaged 0.74 tokens, and the amount of tax evasion averaged 1.26, yielding an average compliance rate of about 37 percent. Note that average compliance rates were fairly consistent across income levels, so that the amount of evasion per capita varied directly with income.

The Tobit regression results are shown in Table 2 for each quintile and for the entire data set. In each case, the regression constant and slope coefficients were always highly significant.[22]

The coefficient estimates allow us to apply equations (8) and (9) to impute the mean values of both risk aversion and the shadow price of morality, as shown in Table 3. In particular, we obtain point estimates for the mean value of λ in the neighborhood of .15 regardless of the experimental income level, implying that moral sentiments consistently acted as psychic taxes on illicit (i.e., undeclared) income at an average rate near 15 percent. In addition, interval estimates for the mean values of A and λ can be obtained by constructing 95 percent confidence intervals for β_0 and β_1 from the regression coefficients and their standard errors; using the lower (upper) bounds for β_0 and β_1

generates the upper (lower) bound for A and λ. The results for λ, given in the third row of Table 3, show that the mean shadow price is significantly greater than zero in each quintile. Across all experimental income levels, the mean value of λ lies in an interval from 13 to 17 percent. Of course, given the pervasiveness of tax evasion in the experiment, it is not surprising to find fairly low estimates for the average shadow price of morality.

TABLE 1
Descriptive Statistics[a]

Income Quintile	1st Quintile	2nd Quintile	3rd Quintile	4th Quintile	5th Quintile	All
Income Endowment	2.00 (.000)	2.25 (.000)	2.50 (.000)	2.75 (.000)	3.00 (.000)	2.50 (.0069)
Declared Income	.73905 (.03667)	.71627 (.03845)	.78968 (.04216)	.99512 (.04793)	.89425 (.05038)	.82687 (.0195)
Tax Evasion	1.26095 (.03667)	1.53373 (.03845)	1.71032 (.04216)	1.75488 (.04793)	2.10575 (.05038)	1.6731 (.0202)
Compliance Rate	.36953 (.01833)	.31834 (.01709)	.31587 (.01686)	.36186 (.01743)	.29808 (.01679)	.33274 (.0078)
Sample size	525	525	525	525	525	2,625

a. Standard errors are in parentheses below means.

TABLE 2
Tobit Regression Results[a]

Income Quintile	1st Quintile	2nd Quintile	3rd Quintile	4th Quintile	5th Quintile	All
Regression Constant	-.027284 (.002482)	-.029016 (.002606)	-.027923 (.002891)	-.034321 (.003190)	-.032570 (.003599)	-.0305 (.0014)
Coefficient of $t - pf$	.1630997 (.008177)	.1914605 (.008702)	.1969215 (.009688)	.2212985 (.010640)	.237419 (.012084)	.20262 (.0045)
Pseudo R-sq	.35586	.40555	.35869	.37282	.34653	.34974
-2log-likelihood	807.601	904.775	870.266	796.035	758.251	4048.2
Std. Error	.026275	.025812	.028884	.03227	.036949	.03098
Sample size	525	525	525	525	525	2,625

a. Standard errors are in parenthesis below regression coefficients. All regression results are significant at the one percent level.

The point estimates for the mean value of absolute risk aversion range from 4.21 to 6.13, and clearly decline as income endowments rise. The argument of the absolute risk aversion function as defined in the model, however, is not endowed income *per se*, but rather expected income, EI. Using the point estimates of λ along with the values of income, tax evasion, and the fiscal parameters, EI can be estimated from equation (3)

TABLE 3
Imputed Values

Income Level	2.00	2.25	2.50	2.75	3.00	All
λ						
Point est.	.16728	.15155	.14180	.15509	.13718	.15067
λ	.12516-	.11466-	.10309-	.11591-	.09773-	.1318-
Conf. int.	.21859	.19566	.18878	.20241	.18539	.17125
A						
Point est.	6.1312	5.2230	5.0782	4.5188	4.2120	4.9354
A	5.5826-	4.7958-	4.6316-	4.1296-	3.8299-	4.729-
Conf. int.	6.7994	5.7338	5.6201	4.9889	4.6787	5.1609
EI						
Point est.	1.75981	2.01247	2.23222	2.42165	2.69009	2.2233
R						
Point est.	10.78978	10.51115	11.33558	10.94291	11.33055	10.973

for each quintile, and these values are shown in the sixth row of Table 3.[23] At the one percent level of significance, there is a negative correlation (r = - .974) between the mean values of A and EI, which indicates decreasing absolute risk aversion (DARA), as originally hypothesized by both Pratt [1964] and Arrow [1965]. The Pratt-Arrow measure of relative risk aversion can also be computed as $R = [EI]A$. Each of our point estimates for relative risk aversion lies slightly above 10, a magnitude consistent with the well-known findings of Mehra and Prescott [1985] concerning the equity premium puzzle, as well as Blake's [1996] more recent estimates, which are also based on investment portfolios.[24, 25] Note that if λ had been omitted (as it is in conventional models of amoral expected utility maximization), compliance would have been attributed entirely to risk aversion. In that case, the value of relative risk aversion needed to explain an overall compliance rate of 33 percent would have been twice as high: 22.19, well beyond the level typically considered realistic. (Even greater values would have been required to explain higher compliance rates such as the 37 percent compliance in the first quintile.) The consistency of our absolute and relative risk aversion findings with prior theoretical and empirical research, respectively, suggests that the model and the experimental data together yield reasonable results.

That conclusion is strengthened by an assessment of the fit between the parameter estimates and the theoretical model. Of course, given the level of evasion, $t - pf$, and σ^2, an infinite number of combinations of A and λ could satisfy equation (5); but any combination that failed to closely satisfy equation (5) would indicate a fundamental inconsistency between the model and its estimation. In the present case, each income quintile has a mean value of $t - pf$ equal to .276, and a mean value of risk equal to .01653; these figures are now inserted into equation (5) along with the imputed values of A and λ to generate fitted values, or estimates of the mean level of evasion.

Those estimates can be compared directly with the observed evasion levels from the fifth row of Table 1. The results are shown in Table 4, where the final row indicates estimation errors, each measured as a fraction of observed evasion. For each quintile, the absolute estimation error is 15 percent or less, and the overall estimation error is only 8 percent in absolute value.[26] The ability of the present model to account for evasion with approximately 92 percent accuracy is all the more compelling in light of the fact, noted above, that models without moral parameters tend to yield highly inaccurate estimates of evasion.

TABLE 4
Model Accuracy

Income Quintile	1st Quintile	2nd Quintile	3rd Quintile	4th Quintile	5th Quintile	All
t-pf	.276	.276	.276	.276	.276	.276
σ^2	.01653	.01653	.01653	.01653	.01653	.01653
λ	.16728	.15155	.14180	.15509	.13718	.15067
A	6.1312	5.2230	5.0782	4.5188	4.2120	4.9354
Estimated Evasion	1.0727	1.4415	1.5987	1.6187	1.9938	1.5363
Observed Evasion	1.26095	1.53373	1.71032	1.75488	2.10575	1.6731
Estimation Error	.149	.060	.065	.078	.053	.082
Accuracy	.851	.940	.935	.922	.947	.918

Although prediction per se is not of primary importance in the present study, we may test the model's predictive ability by dividing the experimental population into two subsets: a regression sample and a smaller prediction sample. As an illustration, the data from the first subject in each session are set aside; the regressions are then run on the observations of the remaining participants, and the resulting parameter estimates are used to predict the average behavior of the eight excluded subjects. Within each income quintile, values of A and λ are imputed from the regression sample, and inserted into equation (5) along with the mean values of risk (σ^2) and the expected compliance cost ($t - pf$) facing the prediction sample, to predict the latter's mean level of evasion. The results are shown in Table 5. Over all incomes, the model yields an absolute prediction error (measured as a fraction of observed evasion) of less than 4 percent. But the overall error is primarily due to poor prediction at the two lowest income quintiles, where evasion is under-predicted by nearly 20 percent and over-predicted by 10 percent, respectively; at the other income levels, the absolute prediction errors are less than 5 percent.[27]

TABLE 5
Prediction[a]

Income Quintile	1st Quintile	2nd Quintile	3rd Quintile	4th Quintile	5th Quintile	All
Regression Sample	491	487	489	496	487	2450
Regression Constant	-.027471 (.002563)	-.027393 (.002722)	-.028271 (.003019)	-.032467 (.003292)	-.029438 (.003718)	-.0290 (.0014)
Coefficient of *t-pf*	.164825 (.008397)	.187706 (.009111)	.198729 (.010054)	.216067 (.011007)	.226119 (.012618)	.19824 (.0047)
Pseudo R-sq	.36496	.38627	.36160	.35339	.31481	.33585
Imputed λ	.166668	.145935	.142258	.150262	.130188	.14653
Imputed *A*	6.06704	5.32749	5.03199	4.62819	4.42244	5.0445
Prediction Sample	34	38	36	29	38	175
t-pf	.251882 (.012879)	.281789 (.016319)	.257556 (.014422)	.281517 (.019407)	.305053 (.019092)	.276 (.0075)
σ^2	.015717 (.001821)	.016046 (.002167)	.013141 (.002092)	.017623 (.002408)	.020098 (.002449)	.01653 (.0010)
Observed Evasion	1.1103 (.1587)	1.4453 (.1582)	1.8056 (.1491)	1.5490 (.2220)	2.0555 (.1986)	1.6040 (.0821)
Prediction	.8936	1.5892	1.7436	1.6093	1.9674	1.5531
Pred. Error	.195	.10	.034	.039	.043	.032
Accuracy	.805	.90	.966	.961	.957	.968

a. Standard errors are in parentheses below means and regression coefficients. All regression results are significant at the one percent level.

Unfortunately, at this stage in the development of the theory, we have no information regarding the influences that bear on one's sense of morality, aside from some rather general speculations regarding the effects of upbringing and social environment; on this, see Reder [1979]. Nor do we have demographic data relating to the individuals in the sample that might shed light on the determinants of their moral sentiments.

CONCLUSION

This paper introduces a preference for morality into the conventional expected utility framework in a new manner that is both sensible and tractable. As a deterrent to unethical—and not merely risky—behavior, the morality parameter is clearly dis-

tinguished from risk aversion. The model is estimated using experimental data from an income tax simulation, and the results strongly suggest that a positive preference for morality is operative on average. The mean shadow price of morality in this experiment appears to lie in a narrow interval around 15 cents per dollar. That is, the utility derived from unreported and thus untaxed income is reduced by the moral equivalent of a tax rate near 15 percent. Morality appears to be independent of the experimental income, whereas our estimates show decreasing absolute risk aversion.

Such measurements may potentially yield important policy implications. For example, fiscal authorities have generally been reluctant to set $pf > t$ as a deterrent to tax evasion; but the model presented here indicates that just setting $t - pf$ below the median value of λ should be sufficient to encourage compliance among most risk averters. In a broader context, measuring λ may give insight into such phenomena as money laundering and black market exchange rates, and thereby aid in setting law enforcement parameters in those areas as well.

The results obtained here may also have relevance for research in other disciplines. Psychologist Lawrence Kohlberg and his colleagues have constructed a "stage theory" of moral development, which holds that individuals pass through six distinct stages of moral reasoning as they progress from childhood through adolescence and into adulthood; see for example Colby and Kohlberg [1987]. According to this theory, obedience to laws and moral codes in the earliest stage is based exclusively on the avoidance of punishment; in later stages, adherence is based on internalized principles of justice without regard to any potential penalties imposed by external authorities. The present findings, however, suggest that an aversion to the risk of incurring a financial penalty continues to motivate young adults even as they exhibit an inherent preference for obeying a moral code. This may mean that vestiges of first-stage reasoning remain with the individual throughout later stages.

In a study of this nature, however, several caveats are in order. First, using undergraduate student volunteers as experimental subjects is one obvious source of potential bias, since students' attitudes may not reflect those of the broader population. Indeed, if the stage theory outlined above is valid, the shadow price of morality should be relatively higher among those at higher stages of moral development. The self-selection of volunteers may create a secondary source of bias, if volunteers differ systematically from other students in their risk aversion or morality. And of course, the experiment itself may introduce a tertiary bias, if subjects do not behave in the experiment as they would in a non-experimental setting. This might occur as the result of framing, or context effects. If the participants view the experiment primarily as a simple, value-neutral game of chance rather than as an income tax simulation, then their morals may be largely irrelevant to their decision-making, and consequently, their behavior may not reflect morality as much as it otherwise would.[28] On the other hand, however, value-neutral experimental instructions may well prevent Hawthorne-type effects: if participants believe their morals are being evaluated, they may become overly self-conscious and exhibit unrealistically high compliance rates (i.e., rates exceeding those they would naturally show in a non-experimental setting). Alternatively, an experimental bias may occur simply because the dollar amounts at stake in the experiment (approximately $15 to $25 per person in the present case) are insuffi-

cient to induce realistic concern on the part of the subjects, though most research seems to suggest that the magnitude (or even the existence) of financial incentives does not significantly alter experimental behavior [Beattie and Loomes, 1997]. Moreover, the general consistency of the risk aversion estimates with those of previous research and the strong fit between the theoretical model and its estimation suggest that such biases have had a minimal influence in the present case.

At the same time, the experimental approach provides several benefits. The most obvious is that it permits a complete and accurate data set to be compiled on behavior that, by its very nature, would not otherwise be subject to honest reporting. The experiment can also be controlled, to admit only those features of the problem relevant for the analysis at hand. Finally, the experiment is replicable, and indeed, it is hoped that this procedure will be replicated in future work as a means of testing the robustness of the present model. Given the large number of similar income tax experiments that have been conducted for other purposes, replication should be particularly easy. Especially useful would be replications that incorporate economic, social, and demographic differences among subjects, including their non-experimental wealth, their family structure, and religious beliefs or practices, and those that incorporate other attitudinal parameters, such as perceptions of fairness and sensitivity to social stigma. Extending this concept of a shadow price of morality beyond models of individual decision-making into game-theoretic models with explicit roles for social interactions among individuals would also allow a rich variety of additional questions to be addressed, such as whether a greater prevalence of deviant behavior makes it more acceptable to the individual, thereby reducing the level of remorse associated with it.

Given the simplicity of the estimation procedure used and the caveats noted above, the results reported here should be seen primarily as illustrative of the shadow price concept. And of course, the model has been developed in the context of income tax compliance, but one can easily contemplate applications to other economic areas involving moral or ethical questions, such as public accounting standards, insurance fraud, purchases of stolen goods, and other underground (or "shadow economy") activities. The preference parameter governing morality may well have different values in these different contexts. Extending the model to such areas should therefore provide ample opportunities for future research.

NOTES

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1. According to Hausman and McPherson [1993, 723], it is only since the 1970s that "economists and moral philosophers have renewed a conversation that was interrupted during the heyday of positivist methodology in both disciplines."
2. Studies attempting to link tax compliance with morality are predicated on the belief that tax evasion—as opposed to legal tax avoidance—is immoral or unethical. Some authors, including McGee [1998] and Pennock [1998], would challenge this premise, arguing that tax evasion is

sometimes morally justified depending on the fairness or use of the tax, but they appear to constitute a small minority. Indeed, many religions proscribe tax evasion, viewing it as a form of theft. The Roman Catholic catechism, for example, now explicitly identifies tax evasion as a grave sin [Clough, 1992]. Though somewhat more circumspect, similar prohibitions can be found in Judaism [Tamari, 1998], Islam [Murtuza and Ghazanfar, 1998], and the Mormon faith [Smith and Kimball, 1998], among others.

3. Similarly, Linster [1997] acknowledges a potential role for social responsibility, but treats it as a component of risk aversion in his model.
4. There is less consensus regarding the effect on compliance of an *increase* in the tax rate. With decreasing absolute risk aversion, Allingham and Sandmo [1972] obtained an ambiguous result due to competing income and substitution effects. Yitzhaki [1974] derived a positive effect by making the penalty rate a linear function of the tax rate, and Yaniv [1994] obtained a negative effect by restricting the utility function.
5. Reder's [1979, 135] default-avoidance concept similarly blurs these distinctions; he notes, "I do not distinguish among the pain of a bad conscience, the loss of social acceptance, and the deterioration of one's credit rating as deterrents to violations of agreements and (therefore) as a prop for morality." Such analyses treat morality as a behavioral outcome, rather than as a preference parameter that influences behavior.
6. Conceptually, a negative (positive) emotional response to one's own wrongdoing that is experienced only while the act goes undetected by others would seem to be largely indistinguishable from the fear of punishment (the thrill of escaping punishment). Such emotions could well be felt by an amoral individual concerned exclusively with external penalties rather than with the inherent wrongfulness of the offense, and thus would not be evidence of moral sentiments per se.
7. Like Erard and Feinstein [1994], Cho, Linn, and Nakibullah [1996] distinguish the psychic cost of remorse from public humiliation, but assume away risk aversion.
8. The possibility that socio-demographic variables also influence other preference parameters might explain why Webley et al. [1991] found no significant effects of personal values, including honesty, inner harmony, and social recognition, on compliance. Alternatively, their lack of significant results may have been due to measurement problems in the data, caused by having participants in experiments subjectively rate themselves in terms of those personal values. More recently, Engelbrecht et al. [1998] found multiple dimensions of ethics to be significant determinants of compliance intentions. Neither of these studies included risk aversion as a motivating factor.
9. Other features of fiscal policy that have been suggested as possible compliance factors are the complexity of the tax code and the use of funds. It has been argued that complexity can discourage taxpayers from properly filing forms, and that taxpayers may be more inclined to comply with tax codes when they receive a direct benefit from public goods that are financed by tax revenue.
10. Note that while disgrace is not explicitly taken into account in this version of the model, it could be done as a straightforward extension, by redefining f as the sum of fines and the cost of disgrace, the latter being the amount one would willingly pay to avoid being ostracized. But as the experiment used to estimate the parameters has no feature of public humiliation or social stigma, the exclusion of disgrace should not induce any omitted-variable bias.
11. Corner solutions occur at full compliance ($YD^* = Y$) and no compliance ($YD^* = 0$). Indeed, a risk neutral individual would maximize expected income by complying fully if $\lambda + pf - t > 0$ and declaring no income if $\lambda + pf - t < 0$.
12. The first-order condition can be rewritten as $(1-p)(t-\lambda)U'(I_N) = p(f+\lambda-t)U'(I_A)$ where I_A and I_N denote income if audited and income if not audited, respectively. The expected income is a weighted average of these, $EI = (1-p)I_N + pI_A$. The Taylor series expansion of the first-order condition is then

$$(1-p)(t-\lambda)(I_N - EI)^0 U'(EI) + (1-p)(t-\lambda)(I_N - EI)^1 U''(EI) =$$
$$p(f+\lambda-t)(I_A - EI)^0 U'(EI) + p(f+\lambda-t)(I_A - EI)^1 U''(EI).$$

Substituting for I_A and I_N produces equation (4), and rearranging gives equation (5).

13. Technically, the condition for $\partial(Y - YD^*)/\partial p < 0$ is $(\lambda + pf - t)(1 - 2p) < p(1 - p)f$. The left-hand side of this expression is negative if $t > pf + \lambda$ (evasion is initially optimal for a risk averter) and $p < .5$ (an audit is improbable). Thus, where evasion occurs, it will almost inevitably be the case that an increase in the audit probability will reduce evasion. As in the original Allingham-Sandmo model, the effect of an increase in t is ambiguous under decreasing absolute risk aversion unless additional restrictions are imposed.
14. In the purely hypothetical case with no legal sanctions and no risk (either $p = 0$ or $f = 0$), the individual would compare the utility of full compliance ($YD = Y$) with the (riskless) utility of total evasion ($YD = 0$), rather than solving the expected utility problem of equation (1). Morality would then preclude evasion if and only if $\lambda > t$.
15. Nor is it necessary in principle that λ be a constant, though this assumption greatly facilitates the estimation undertaken in the next section. For a more extensive theoretical discussion, see Eisenhauer [2004].
16. Randomized response sampling (RRS) represents a potential solution, though recent tax applications showed no significant improvements over conventional surveys in response rates or the likelihood of admitting noncompliance, either among taxpayers [Houston and Tran, 2003] or among professional tax practitioners [Larkins et al., 1997].
17. See, for example, Alm, McClelland, and Shulze [1992], Baldry [1986; 1987], Becker, Büchner, and Sleeking [1987], Friedland [1982], Friedland, Maital, and Rutenberg [1978], Robben, et al. [1990], Spicer and Becker [1980], Spicer and Hero [1985], Spicer and Thomas [1982], and Webley et al. [1991].
18. In the early- to mid-1990s, for example, federal income tax rates ranged from 15 to nearly 40 percent, and audit rates ranged from less than 1 percent to more than 5 percent, depending upon the type and amount of income in question; see, for example, Slemrod and Bakija, [2000].
19. That is, each individual paid tYD, but was reimbursed in the amount of $2(tYD + \theta)/5$, where θ denotes the sum of the tax payments made by the four other members of the same group. The individual's net tax payment was then $tYD - .4(tYD + \theta) = .6tYD - .4\theta$. Thus, although the stated tax rate was 30 percent in that session, the effective tax rate on declared income was less than or equal to 18 percent after the transfer payment. Note also that if group members had known each other's identities, inclusion of the public good might have made public disgrace a relevant issue in that session, as an individual could have calculated the average tax paid by others in the group ($\theta/4$), and might thus have drawn inferences regarding their compliance rates, as occurred in the public goods experiment conducted by Ostrom, Walker, and Gardner [1992]. Group members were unknown to each other in the present study however, and the results indicate that the public good was not a particularly effective deterrent to evasion.
20. There is an interesting analogy between paying taxes and voting. The contribution of the individual to personal and social welfare is negligible in both cases, yet sizeable numbers nonetheless comply with the social norms, either because they misjudge the benefits and costs or because they believe it is the ethically correct thing to do. Thus, it may not be surprising that average compliance rates were positive even without a direct benefit in the form of a public good. I thank Kenneth Koford for pointing this out.
21. At least three other potential empirical specifications are suggested by equation (5). Nonlinear regression is possible, but requires some *a priori* knowledge regarding the likely magnitudes of A and λ. Log-linear regression of evasion on the mean/variance ratio is another possibility, but the dependent variable is then undefined for instances of full compliance. Multiple linear regression of evasion on $1/\sigma^2$ and $(t - pf)/\sigma^2$ without an intercept is also possible, but the presence of σ^2 in both terms creates multicollinearity, which severely distorts the estimates of the coefficients. Judging by the consistency of its estimates with the theoretical model (as discussed below), the specification reported here gives the most reliable results.
22. Replications that included the eighth session used a public good indicator as a control variable. Its positive marginal effect on evasion showed that the redistribution of tax revenue among group members did not impose a social stigma on tax evaders. On the contrary, rather than deterring evasion, the presence of the public good appears to have encouraged a small amount of free riding,

equal to roughly 1 percent of total evasion. Because the public good reduces the effective tax rate, its theoretical effect on evasion is ambiguous in models of the Allingham-Sandmo type unless further restrictions are imposed (see notes 4 and 13 above). Overall, the results were essentially unchanged by the presence of the public good.

23. For each quintile, the mean tax rate is .30, and the mean value of *pf* is .024. Of course, there is variation in *EI* within each quintile caused by variation in t, *pf*, *YD*, and λ, but for simplicity we report only the point estimates.
24. See also the risk aversion estimates recently obtained by Eisenhauer and Ventura [2003]. Lower values obtained in previous research using linearized Euler equations have been strongly criticized as severe underestimates by Ludvigson and Paxson [2001].
25. The point estimates of R in the five quintiles have no significant correlation with either endowed or expected income; as a result, constant relative risk aversion cannot be rejected.
26. By comparison, the model used here outperforms each of the alternative specifications suggested in note 21 above. For example, a Tobit regression of evasion on $1/\sigma^2$ and $(t - pf)/\sigma^2$ over all income levels gives point estimates of $\lambda = .025856$ and $A = 32.300$; these figures yield an absolute estimation error of 72 percent, and are thus clearly implausible values.
27. Because the subjects were identified in each session simply by the computer stations they used, selecting the first subject in each session for use in the prediction constitutes a form of systematic random sampling. Of course, numerous other subsets of the data could be chosen for this exercise, and the results are sensitive to this choice: the regression model naturally predicts well for groups whose behavior is near the trend, and predicts poorly near outliers.
28. The evidence on the effect of framing in tax evasion experiments is inconclusive. Alm, McClelland, and Schulze [1992] found that framing did not affect experimental outcomes, but Baldry [1986] found context to be of central importance.

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