INTEGRATING CELERITY, IMPULSIVITY, AND EXTRALEGAL SANCTION THREATS INTO A MODEL OF GENERAL DETERRENCE: THEORY AND EVIDENCE*

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We propose a model that integrates the extralegal consequences from conviction and impulsivity into the traditional deterrence framework. The model was tested with 252 college students, who completed a survey concerning drinking and driving. Key findings include the following: (1) Although variation in sanction certainty and severity predicted offending, variation in celerity did not; (2) the extralegal consequences from conviction appear to be at least as great a deterrent as the legal consequences; (3) the influence of sanction severity diminished with an individual's "present-orientation"; and (4) the certainty of punishment was far more robust a deterrent to offending than was the severity of punishment.

Deterrence studies focusing on the certainty and severity of sanctions have been a staple of criminological research for more than 30 years. Two prominent findings from this literature are that punishment certainty is far more consistently found to deter crime than is punishment severity, and the extralegal consequences of crime seem at least as great a deterrent as do the legal consequences (Nagin, 1998; Williams and Hawkins, 1986). Going back to Beccaria, punishment imminence ("*celerity*") has been accorded co-equal status with certainty and severity in theory, yet empirical tests of the celerity effect are scant.

This paper aims to advance this well-trodden intellectual and empirical ground by proposing and testing an integrated model of certainty, severity, and celerity. The framework of the model enables us (1) to investigate punishment celerity, not in isolation as the few previous studies of celerity

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have done, but as it relates to certainty and severity; (2) to distinguish the independent roles of legal and extralegal sanctions; (3) to incorporate aspects of individual difference theories into a rational choice approach; and (4) to explain the finding that punishment certainty is a more effective deterrent than is punishment severity.

Our model relies on two sources outside conventional explanations of deterrence. One is familiar to criminologists. In *A General Theory of Crime*, Gottfredson and Hirshi (1990) argue that persons who engage in crime can be distinguished by their "here and now" orientation. Wilson and Herrnstein (1985) similarly emphasize the impulsivity of criminals in their treatise, *Crime and Human Nature*. We formalize these complementary ideas with a foundational economic concept, "discounting." Economics uses "discounting" to compare consequences realized at different times. Nagin and Paternoster (1994) use this intuition to explain differences in investment in social bonds. Here, we make formal use of a discount factor to link the timing of punishment, the defining concept of celerity, and the amount of punishment, the defining concept for certainty and severity.

We also develop several novel techniques for measuring the aforementioned discount rate and placing a monetary value on the legal and extralegal consequences of criminal behavior. As elaborated below, we believe these advances in measurement have broader application in criminology.

INTEGRATIVE DETERRENCE

Contemporary deterrence theory, which descends virtually intact from the Enlightenment philosophers Beccaria and Bentham, continues to face mixed support for its three main predictions. Although punishment certainty has been consistently found to deter criminal behavior (Horney and Marshall, 1992; Parker and Grasmick, 1979; Paternoster et al., 1985), the evidence for severity (Decker et al., 1993; Klepper and Nagin, 1989; Nagin and Paternoster, 1993; Piquero and Rengert, 1999) and celerity (Howe and Loftus, 1996; Legge and Park, 1994; Yu, 1994) effects is inconclusive. Further, as a purely situational account of criminal behavior, deterrence theory neglects the growing list of personal traits that appear to predict offending (cf., Block and Gerety, 1995; Evans et al., 1997; Fergusson et al., 2000; Longshore et al., 1996; Moffitt, 1993; Moffitt and Caspi, 2000; Moffitt et al., 1994; Nagin and Tremblay, 1999; Nagin et al., 1995; Seguin et al., 1999; Wallace and Newman, 1997). This paper proposes an integrative deterrence model that aims to more effectively reconcile extant findings and provide a more descriptively accurate account of criminal conduct.

In contrast to the considerable attention devoted to certainty and severity effects, few studies investigate punishment celerity. This oft-neglected

deterrence prediction appears grounded in psychological investigations of "Pavlovian conditioning." In such studies, experimenters effectively suppressed animal behaviors with negative reinforcements occurring within six seconds following the targeted behavior. Criminology has adopted this finding as the basis for a celerity effect—that is, in similar fashion, delay should diminish the deterrent efficacy of a legal sanction. This analogy, however, neglects the fact that humans possess a far greater cognitive capacity than do animals for connecting acts with temporally remote consequences. Even more, the criminal justice system is designed specifically to remind defendants of the allegations against them at least several times during litigation. With respect to general deterrence, application of Pavlovian conditioning is even further strained. Although such conditioning results from prior punishment of the decision maker, general deterrence occurs when the decision maker contemplates the punishment experiences of others. General deterrence, then, does not concern a "connection" between behavior and consequences, but whether potential consequences already recognized by the decision maker seem sufficiently "costly" to deter behavior.

For these reasons, commentators have criticized the current theoretical basis for a celerity effect (cf., Gibbs, 1975; Howe and Brandau, 1988; Tittle, 1980). On this point, Gibbs (1975:130–131) has observed:

> The only rationale for an emphasis on celerity is found in experimental psychology, notably research on "operant" behavior, classical (Pavlovian) conditioning, or aversive conditioning. . . . it is difficult to see how (such) experimental findings support the assumption that differences among jurisdictions or types of crime can be attributed even in part to contrasts in the celerity of punishment. In any case, one would surely be pressed to argue that the importance of the celerity effect extends beyond specific deterrence.

We share Gibbs's contention that classical conditioning provides an insufficient basis for a celerity effect. As to Gibbs's latter contention that the timing of punishment is therefore irrelevant to general deterrence, we wholeheartedly disagree.

An alternative basis for a celerity effect derives from straightforward economic reasoning about the "time value of money." Consider the future obligation to pay $1,000. There is a sensible basis to want to defer the obligation in order to use the funds and produce offsetting benefits in the interim. Imagine making an immediate payment that would relieve the obligation. The maximum acceptable payment, a plausible measure of the present aversiveness of the obligation, is likely to diminish as the payment date is further delayed. If evaluation of a future criminal sanction resembles that for a future financial obligation, the result is a celerity effect—the

sooner the sanction is expected to commence, the greater its current costliness and resulting deterrent potential.

Ultimately, however, it is an empirical question whether this commonsense economic logic applies to criminal sanctioning. First, unlike a monetary obligation, there is no compelling reason to predict that individuals would be more likely to prefer to delay a sanction than they would be to want to "get it over with." Second, no natural reference exists to calibrate the strength of any preference for delay. In economics, the market interest rate provides an appropriate benchmark to "discount" a future financial obligation. To see this, imagine that funds are expected to earn 10% per year and we are again offered a choice to relieve a future $1,000 obligation with an immediate payment. If the funds were due in one year, the immediate acceptable payment should not exceed 1/1.1($1,000) = $910. If the obligation was due in three years, the immediate acceptable payment should not exceed $(1/1.1)^3$($1,000) = $750. No such objective standard exists by which to "discount" future criminal sanctions.

The concept of celerity, as we have currently redefined it, thus captures only one side of the role of timing in criminal decision making. A "celerity effect" is only possible for someone who would prefer to delay a sanction. Further, as the above financial example shows, the magnitude of any celerity effect depends on the strength of the preference for delay. For example, if the interest rate was 20%, the preference for delay is even greater. The immediate acceptable payment to relieve the $1,000 obligation one year hence would be 1/1.2($1,000) = $833. More generally, for any individual, the impact of celerity depends inextricably on whether and to what extent delay produces the devaluation of future consequences. This latter aspect of timing invokes the well-known criminological concept of "impulsivity" or "present-orientation."

Wilson and Herrnstein (1985) associate impulsivity with an inability to plan for the future. Gottfredson and Hirschi (1990) define impulsivity as the disproportionate adoption of a "here and now" orientation, in contrast to those who more often "defer gratification." In their subsequent "self-control scale," Grasmick et al. (1993) measure impulsivity by asking subjects to report their level of agreement with statements like "I often do what brings me pleasure here and now, even at the cost of some distant goal," and "I'm more concerned with what happens to me in the short run than in the long run" (Grasmick et al., 1993:14-15).

As with celerity, at its core, impulsivity relates to the effect of timing on the perceived magnitude of consequences. In particular, impulsivity describes the degree to which an individual eschews the future for the present, which, in economic terms, is reflected in the discount rate. Recall the individual contemplating an immediate payment to relieve a $1,000 obligation due in one year. A market interest rate of 10% provides a credible

basis to predict that the maximum acceptable amount should not exceed 1/1.1($1,000) = $910. If, however, the individual enjoyed gambling on professional sports, the gambling impulse could cause the maximum acceptable payment to be far less than $910. In this context, the gambler's impulsivity is evidenced by a high discount rate for the future $1,000 obligation. If, for example, the maximum acceptable payment was only $100, the implied discount rate, denoted by r, is markedly higher than is the market interest rate. It can be inferred to equal 900% by solving for the value of r such that $(1/1 + r)($1,000) = $100.

We have thus far reframed the concepts of impulsivity and celerity and advocated their inclusion in the traditional deterrence framework. In doing so, however, we have focused on the deterrent properties of legal sanctions, which, as a number of scholars have now convincingly shown, represent only one of myriad potential behavioral influences. Meier and Johnson (1977:295) recognize the complications that alternative sources of conformance pose for deterrence theory:

> There is no basis for presuming that other (extralegal) influences are somehow "controlled" when the bivariate relationship between legal sanctions and crime is measured. The important question which is not addressed by such studies is: when is compliance the result of legal threats, and when is it the result of other factors? . . . The rate of nonviolation may actually reflect two sources of compliance: (1) compliance produced by influences other than a legal threat and (2) compliance produced by legal threats.

Grasmick and Bursik (1990) add specificity to the observations of Meier and Johnson (1977) by delineating two such "extralegal" sources of conformity. Embarrassment is the social analogue to the legal sanction. It refers to disapproval of the transgression by individuals to whom the offender has significant personal attachments, such as spouses, friends, family, and colleagues. In contrast, shame follows a criminal act when the offender suffers personal dissonance from having violated an internalized behavioral norm.

Ensuing studies investigating extralegal sanctions have shown that a belief that illicit conduct is wrong (cf., Burkett and Ward, 1993; Foglia, 1997; Paternoster and Simpson, 1996) and the fear of peer disapproval, embarrassment, or social stigma (cf., Andenas, 1974; Grasmick and Bursik, 1990; Nagin and Paternoster, 1994; Tittle, 1980; Williams and Hawkins, 1992; Zimring and Hawkins, 1973) discourage offending behavior. Further, several studies investigating the relative strength of both sanction forms find the conforming influence of extralegal sanctions to be far greater than that from legal sanctions (Bachman et al., 1992; Grasmick and Bursik, 1990).

The foregoing research suggests that in addition to accounting for the role played by the timing of sanctions, deterrence theory should permanently delineate alternative sanction forms to promote a more complete understanding of criminal decision making. Elaborating on the technical structure shared by most rational choice theories of crime, we outline a more expansive model of deterrence.

MODEL AND PREDICTIONS

MODEL

Like most theories, ours builds on the work of others. We expand the existing rational choice framework to include celerity and impulsivity, redefined in terms of the effect of delay on the evaluation of consequences. The model also adopts the longstanding distinction between legal and extralegal consequences of crime that was advanced by Andaneas (1974) and Zimring and Hawkins (1973) and explored empirically in more recent work (cf., Grasmick and Bursik, 1990; Klepper and Nagin, 1989; Nagin and Paternoster, 1994; Tittle, 1980).

In the simple cost-benefit calculus at the heart of general deterrence theory, an individual will offend if

$$U(\text{Benefits}) > pU(\text{Costs}), \tag{1}$$

where $U(*)$ is a utility function that evaluates the benefits and costs of crime in a common metric, and p is the perceived risk of being sanctioned.[1]

We next generalize the model to distinguish between legal and extralegal sanctions as follows:

$$U(\text{Benefits}) > pU(\text{Legal Costs} + \text{Extralegal Costs}). \tag{2}$$

Equation 2 reflects a simplifying assumption that extralegal sanction costs are triggered only by the imposition of a legal sanction. However, as Grasmick and Bursik (1990:841) recognize, "An actor can feel ashamed or be embarrassed even if the state does not detect the behavior." Williams and Hawkins (1986) also distinguish such "stigma from the act" from stigma that can originate from apprehension by authorities.

Absent some mechanism to account for nonlegal sources of conformance independent of the criminal justice system, Equation 2 can be taken

1. Equation 1 assumes the benefits are not contingent on avoiding detection. This assumption most likely applies to crimes that yield benefits intrinsic to the act, like physical victimization, vandalism, or drunk driving. Yet for certain transgressions, like property crime or embezzlement, the act is a means to obtain tangible spoils. In this latter case, apprehension normally entails the confiscation of benefits. Equation 1 can therefore be modified to reflect the necessary contingency: Offend if $(1 - pU(\text{Benefits}) > pU(\text{Costs})$.

to suggest that if there is no possibility of punishment, the crime must occur. On this point, Nagin and Paternoster (1994) add a term, U(Moral Regret), to the cost side of the ledger. This permits their model to account for individuals who, irrespective of instrumental concerns, will simply not offend. In their model, for such individuals, even if apprehension is impossible, U(Moral Regret) can exceed U(Benefits) and produce restraint.

Our model addresses this issue differently. Williams and Hawkins (1986) also observe that stigma from the act is likely to be least relative to stigma from arrest, for crimes that are simply *mala prohibita*, like marijuana use or drunk driving among college students. That said, even for relatively *mala prohibita* crimes, some influence by independently triggered extralegal constraints is likely. Our model accounts for such moral opposition through the utility function. As such opposition increases, U(Benefits) is reduced. For individuals whose independent restraint is of such magnitude that under no circumstances would they offend, we assume the crime is not therefore beneficial. In this case, U(Benefits) = 0 and, by the logic of Equation 2, the crime will not occur.[2]

Equation 2 embodies the traditional certainty and severity predictions. An increase in either the certainty of punishment, p, or the severity of the legal sanction, Legal Costs, increases the right side of the inequality, thus reducing the likelihood of offending. This rudimentary expression highlights the tenuousness of a celerity effect under current theory; unlike the certainty and severity prediction, a celerity effect is not formally represented.

We remedy this deficiency by formally accounting for the independent effects of the timing of costs and rewards on the criminal decision. Complex problems often demand two types of commensuration. One relates to unlike quantities—for example, the pleasure from stealing a desired object must be balanced against the cost of being attacked by the owner during its theft.[3] Another entails the commensuration of like quantities that occur at different times. For example, a certain $500 fine in the future may not entirely offset an immediate $500 in stolen cash. Although nominally equivalent quantities, a direct comparison requires assignment of some present-day magnitude to the $500 future loss. This latter type of commensuration is particularly relevant for criminal decision making—although the benefits from crime often accrue immediately, the costs typically await the outcome of a criminal investigation or legal proceeding.

Our model uses the notion of discounting as an "intertemporal

2. We introduce later a new method to identify such individuals and thus determine the robustness of our results to their exclusion from the analysis.

3. The utility function, $U(*)$, accomplishes this first type of commensuration.

exchange rate" to balance future costs with immediate gains. We thus incorporate a discount factor, δ_t, that assigns weight to future costs for contemporaneous decision making. In the expanded model, offending depends on whether

$$U(\text{Benefits}) > \delta_t p U(\text{Legal Costs} + \text{Extralegal Costs}), \quad (3)$$

where the value of the discount factor is

$$\delta_t = 1/(1 + r)^t. \quad (4)$$

In this expanded model, the disutility of legal and extralegal costs is scaled by δ_t. The degree of scaling depends on t, the number of time periods over which onset of the sanction is expected to be delayed ("celerity"), and r, an individual's "discount rate," which governs the degree to which delay produces the devaluation of future consequences ("impulsivity").

We illustrate the impact of t and r on δ_t with an example. Table 1 computes δ_t for $t = 1, 2$, and 3 periods of delay and for $r = .10$ and $r = .20$. Also reported are the counterpart present values of a $1,000 fine for various combinations of t and r. As illustrated previously, higher discount rates connote greater impulsivity. To reflect this, the discount factor produces a greater proportionate reduction in the future costs of crime, the higher the value of r. For example, assuming a sanction is delayed one period, for $r = .10$, the discount factor is .91, whereas for $r = .20$, $\delta_t = .83$. Thus, although the present-day equivalent of a $1,000 fine for $t = 1$ and $r = .10$ is $910, this value falls to $830 for the more impulsive individual with $r = .20$.

Table 1. Discount Factor and Present Dollar Equivalents for Various Discount Rates and Periods of Delay

	Discount Factor (δ_t)		Present Value of $1,000	
Expected Payment Period (t)	$r = .10$	$r = .20$	$r = .10$	$r = .20$
$t = 1$	.91	.83	$910	$830
$t = 2$	.83	.70	$830	$700
$t = 3$	.75	.57	$750	$570

The discount factor also operationalizes the concept of celerity. For a given impulsivity level, the decay in deterrence depends on t—the longer the expected delay, the greater the decline. For example, for $r = .10$ and $t = 2$, $\delta_t = .83$, whereas when t increases to 3, $\delta_t = .75$. When our hypothetical $1,000 fine is delayed two time periods, its present impact equates to an immediate $830 fine, and an additional period of delay reduces its present impact to $750.

The full model in Equation 3 integrates important features of theoretical and empirical deterrence research. The model recognizes that severity effects are possible from both legal and extralegal sanctions. It expands the traditional approach by linking punishment celerity to punishment certainty and severity. It also integrates situational characteristics of the offending decision, namely, certainty, severity, and celerity, with present orientation, an individual trait. Incorporating these several themes into one model improves the framework for studying the criminal decision and provides a guide to model specification.

PREDICTIONS

STANDARD DETERRENCE PREDICTIONS RELATING TO CERTAINTY, SEVERITY, AND CELERITY

As noted earlier, the right-hand side of the inequality in Equation 3 measures the "downside" of crime, or the expected consequences of apprehension and conviction. The likelihood the individual will experience the costs, $\delta_t pU$ (Legal Sanctions + Extralegal Sanctions), increases in proportion with p, the probability of sanction. Thus, the model accords with the commonsense prediction that the disutility of crime increases with p, the certainty of punishment.

Similarly, the disutility of crime increases as the costs of its legal consequences increase. This accords with the prediction that greater punishment severity should produce greater deterrence. The amount by which legal sanctions (and extralegal sanctions) reduce utility depends on the discount factor, δ_t. As δ_t becomes smaller, the individual places less weight on the future punishment. As demonstrated above, δ_t declines as t, the delay to punishment, increases. The result is the standard celerity prediction—the longer the delay to punishment, the smaller its deterrent effect.

THE DETERRENT IMPACTS OF EXTRALEGAL AND LEGAL SANCTIONS

Numerous studies have shown that a belief illicit conduct is wrong (cf., Burkett and Ward, 1993; Foglia, 1997; Paternoster and Simpson, 1996) and that the fear of peer disapproval, embarrassment, or social stigma (cf., Andenaes, 1974; Grasmick and Bursik, 1990; Nagin and Paternoster, 1994; Tittle, 1980; Williams and Hawkins, 1992; Zimring and Hawkins, 1973) discourages offending behavior. In our model, the relative deterrent impact of legal and extralegal sanctions is an empirical, not a theoretical issue. We introduce below a novel method for estimating these two costs in a common metric, dollars, in order to compare their relative sizes.[4]

4. However, note that if the extralegal costs are experienced immediately following detection, but the legal costs are delayed following conviction and exhaustion of

The deterrent effects of legal sanctions are smaller for most present-oriented individuals

This prediction follows directly from our discussion of the celerity prediction above. We again refer to the cost side of the inequality in Equation 3, $\delta_t pU$ (Legal Sanctions + Extralegal Sanctions), representing the "discounted," expected negative consequences, legal and extralegal, from apprehension and conviction. As legal sanctions increase, so too does the disutility from crime, which produces a severity effect. However, in the model, the costs of conviction are reduced by a discount factor, δ_t before they are balanced against the benefits. As Table 1 demonstrates, the discount factor declines with r, our theoretical measure of present orientation. Higher discount rates produce larger reductions in the magnitude of legal sanctions, thus lessening the disutility threatened by a possible legal sanction.

The certainty of punishment is a greater deterrent than is the severity of punishment

Consider again the punishment component of Equation 3, $\delta_t pU$ (Legal Sanctions + Extralegal Sanctions). An increase in p increases the likelihood of experiencing both the legal and extralegal costs of conviction, whereas an increase in legal sanctions directly affects only one of the two sanction forms. Thus, as emphasized by Williams and Hawkins (1986), an increase in p triggers both legal and extralegal consequences. The implication is that even if the magnitude of legal sanctions is small, increases in certainty will have a deterrent effect even as increases in legal sanctions have none.

METHODS

To investigate the predictions outlined above, we administered a survey to several large undergraduate classes at the University of Arizona. The survey posed the following scenario involving the possibility of driving while over the legal limit for blood-alcohol level:

> Suppose you drove by yourself one evening to meet some friends in a bar on Fourth Avenue. Since it is a holiday, the police have increased the number of drinking and driving patrols, and may even conduct random sobriety checks. By the end of the evening, you've had enough drinks so that you're pretty sure your blood alcohol level is above the legal limit. Suppose that you live about 10 miles away and you have to be at work early the next morning. You can either drive

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appeals, a celerity-type argument can also be made for the greater impact of extralegal consequences.

> home or find some other way home, but if you leave your car at the bar, you will have to return early the next morning to pick it up.

Fourth Avenue, which is the site of several popular night spots, is well known to most University of Arizona students. We chose the issue of drinking and driving and set the scenario in a familiar locale in order to lend realism to subjects' judgments.

Before estimating the chance they would drive under the circumstances above, respondents estimated on a scale from 0 to 100 the likelihood they would be apprehended for and convicted of drunk driving if they drove home. We label this variable CERTAINTY.[5] We next informed subjects of the timing (CELERITY) and SEVERITY of the penalty, which involved a suspension of driving privileges. We randomly assigned subjects one of three different suspension lengths: 3, 9, or 15 months. For each subject, we employed one of three different celerity levels. Subjects were informed the suspension period could be expected to begin either 6, 12, or 18 months from the date of the offense. Our experimental manipulations thus produced a 3×3 factorial design. After providing a certainty estimate and learning of the severity and celerity level, each subject estimated on a scale from 0 to 100 the likelihood they would drive home under the circumstances provided in the scenario. This response, which we denote LIKELIHOOD OF OFFENDING, is the response variable for later analyses.

The model also requires that we measure two additional aspects of the decision environment—the degree to which the subject is influenced by extralegal rather than legal sanctions and the subject's degree of present orientation. To measure the former, subjects were asked to imagine that they indeed had driven home and received a summons for drunk driving, and that they were assigned a court-appointed lawyer with whom their chance of escaping conviction was 50%. However, they could hire lawyer B, who over many years of trying drunk-driving cases had never lost a case. With lawyer B, the subject was virtually assured of escaping conviction. The subjects were asked to write down the maximum total legal fee they would be willing to pay to retain lawyer B. The total cost of conviction (TOTAL COST), including both legal and extralegal consequences, was estimated at two times (1/.5) their answer to this question.[6] Next,

5. Rather than experimentally manipulate punishment certainty, we allow subjects to estimate their certainty level. We do this to avoid the artificiality of furnishing detection probabilities that subjects may find unrealistic. Klepper and Nagin (1989) outline the rationale for this approach in detail.

6. Because subjects had a 50% chance of an outright acquittal with the public defender, the sum reported equated to "purchasing" the remaining 50% chance of escaping a conviction and its attendant consequences. We therefore multiplied the answer by 2 in order to obtain the total value placed on avoiding conviction.

subjects were asked to assume lawyer B was too busy to handle the case, but that lawyer C was available. Lawyer C is better than the court-appointed lawyer, but not as good as lawyer B. Lawyer C could arrange the following plea bargain: The subject would plead guilty to drunk driving but avoid any legal penalties. Thus, with lawyer C, the legal consequences of conviction are avoided but the extralegal consequences are not. Subjects now wrote down the maximum total legal fee they would be willing to pay to hire lawyer C. We estimate the dollar value the respondent places on extralegal consequences (EXTRALEGAL COST) by two times the difference in the respondent's willingness-to-pay for lawyers B and C.[7]

We elicit subjects' discount rates with a question patterned directly after the logic of the discount factor. The procedure is one of several that have been used in the decision making literature to elicit discount rates for non-pecuniary consequences (Cropper et al., 1994; Frederick, 1999). Subjects were asked to imagine they were convicted for drunk driving, and although some judges imposed a license suspension immediately, others permitted the suspension period to begin on some later date. The subject filled in the blank in order to complete the following statement: "I can't decide which penalty is worse—a 6-month suspension beginning immediately or a __ month suspension beginning in t (t = 1, 2, or 5) year(s)." Each subject answered three such questions, one for each possible value of t.

Each such response to this question was used to solve for the value of the discount rate, r, that equates the relationship, 6-month suspension = $1(1 + r)^t$(future equivalent). Rearranging the previous equation, that value of r equals (future equivalent/6 month suspension)$^{1/t} - 1$. For each subject, we average the three resulting estimates of r to form the variable, DISCOUNT RATE. As described below, we also use a binary variable called NEGATIVE DISCOUNTER, which equals 1 for individuals whose average discount rate was negative.

We also elicited several personal control measures. The subjects provided their AGE, GENDER, and WEEKLY INCOME. In addition, they indicated the number of times they had previously driven drunk (DRUNK-DRIVING FREQUENCY) and whether they or any relatives or close friends had ever been involved in an alcohol-related traffic accident (ACCIDENT). They were also asked whether they had ever been convicted of or arrested for drunk driving. Less than 3% of the sample responded affirmatively to these questions, thus providing insufficient variation to use these variables in the analyses.

7. During later multivariate analyses, we control for each subject's weekly income to account for possible heterogeneity in the "disutility" from the expenditure of legal fees.

RESULTS

A total of 252 University of Arizona undergraduates completed the survey. The average age was 23 years old, and 54% of subjects were male. The average weekly income in the sample was $271, with 12% of subjects indicating they earned less than $100 per week and 15% stating they earned more than $500 weekly. Respondents admitted to considerable drinking and driving—the mean number of times subjects reported having previously driven drunk was 8, with 17% admitting they had done so on more than 20 occasions.[8]

On average, the imputed cost of license suspension, the legal consequence of conviction, was $2,307. Variation across respondents was substantial. The tenth percentile imputed was $0, whereas the ninetieth was $20,000. Subjects' imputed cost of extralegal consequences was $4,343, nearly double the value for legal consequences.[9] Again variation across respondents was substantial. The tenth and ninetieth percentile imputed values were, respectively, $0 and $40,000. Although this result suggests the greater prominence of extralegal sanctions, we examine the impact of both sanction forms on offending behavior with a series of regressions.

The first column in Table 2 reports a baseline regression that provides a starting point for further analyses. We omit the variables AGE, ARREST, and CONVICT from this and further regressions because of insufficient variation in subjects' responses. The dependent variable is the subjects' estimate on a scale from 0 to 100 of the likelihood that under the circumstances described in the scenario and given the penalty if caught, they would drive home while intoxicated. Because a substantial proportion of respondents (32%) answered 0, we estimate tobit regressions.

We find both a certainty and a severity effect. In the baseline model in Table 2, the coefficients for both sanction probability and severity are negative and statistically significant for $\alpha = .05$ or smaller. As for the magnitude of the certainty effect, the estimated coefficient suggests on average each 10% increment in sanction probability (e.g., from 40% to 50%) reduces subjects' probability of driving drunk by 3.3%.[10] Because the

8. Appendix 1 contains a complete description of variables and corresponding summary measures.

9. $p = .000$ for a two-tailed hypothesis test for difference in means.

10. The tobit model assumes the observed response variable y is related to a latent variable, $y^* = x\beta + \varepsilon$ as follows: $y = 0$ if $y^* \leq 0$ and $y = y^*$ if $y^* > 0$. The model assumes that ε is normally distributed with mean zero and standard deviation σ. Following Greene (1990), we compute the marginal effect of a covariate x_j on the censored quantity y by $P(y^* > 0)\beta_j$, where $P(y^* > 0)$ is the probability of $y^* > 0$ and β_j is estimated impact of x_j on y^*. According to this relationship, a one-unit change in x does not change y by the full amount of β. Instead, the impact must be factored down by $P(y^* > 0)$. Thus, in calculating the impact of a specific regressor on the probability of drunk

Table 2. Tobit Regressions: Dependent Variable Is LIKELIHOOD OF OFFENDING (standard errors in parentheses)

	Baseline Model	Model 2	Model 3
SEVERITY	−1.01*	−.86	−.88
	(.47)	(.47)	(.47)
CERTAINTY	−.49**	−.51**	−.51**
	(.09)	(.09)	(.09)
CELERITY	.37	.53	.52
	(.48)	(.48)	(.48)
ACCIDENT	.33	1.06	1.25
(Yes = 1; 0 otherwise)	(4.62)	(4.64)	(4.57)
GENDER	.55	2.79	2.84
(Male = 1; 0 otherwise)	(4.99)	(4.99)	(4.98)
DRUNK-DRIVING	1.51**	1.44**	1.43**
FREQUENCY: # Times	(.28)	(.27)	(.27)
Previously Driven Over Legal			
Limit			
WEEKLY INCOME	.002	.007	.007
	(.015)	(.015)	(.015)
EXTRALEGAL COST: Dollar		−.001*	−.001**
Value Placed on Avoiding		(.0005)	(.0004)
Extralegal Sanction			
LEGAL COST: Dollar Value		−.0002	
Placed on Avoiding Legal		(.0007)	
Sanction			

NOTES: 1—For all regressions, $N = 251$; sample excludes one outlying observation.
2—Constant included in all models.
* $p < .05$ for H_0: $\beta = 0$; ** $p < .01$ for H_0: $\beta = 0$.

average reported offending likelihood in the sample was 31% with a median of 20%, the 10% increment in sanction probability produces about a 10% reduction in offending likelihood from its mean value. As for the severity effect, its coefficient estimate implies that a 10-month increase in the suspension period will reduce the drunk-driving probability by 6.8%. Although the coefficient for celerity is positive and hence in the predicted

driving, we multiply the estimated regression coefficient by the proportion of the sample who report a nonzero probability of driving drunk, .68.

direction, it is statistically indistinguishable from zero. The only other variable that significantly predicts offending in this baseline model is previous drinking and driving. The number of times respondents admit to previous drinking and driving is positively related to their reported offending likelihood. Although this result is not surprising, it bolsters our confidence in the validity of subjects' responses.

Table 2 also enables us to compare the deterrent impact of extralegal and legal sanctions. Model 2 adds these two imputed costs to the baseline regression. Controlling for a subject's weekly income, the value placed on avoiding the extralegal consequences of conviction significantly predicts offending behavior, whereas the value placed on avoiding the legal consequences does not. The coefficient for EXTRALEGAL COST suggests each $1,000 increase in the value placed on avoiding the extralegal consequences produces an additional .7% worth of deterrence.

The results thus far provide some support for our second hypothesis that the deterrent impact of extralegal sanctions is at least as great as that of legal sanctions. First, subjects place far greater monetary value on avoiding the extralegal consequences of conviction. Second, in model 2, adding the EXTRALEGAL COST causes an approximate 15% reduction in the severity coefficient and reduces its significance level to marginal status ($p < .07$). Yet these findings yield an apparent contradiction—although the length of the license suspension (SEVERITY) appears to predict offending, the monetary value placed on avoiding the license suspension does not. This latter finding remains intact even when we estimate model 2 without SEVERITY to purge any possible colinearity with legal costs.

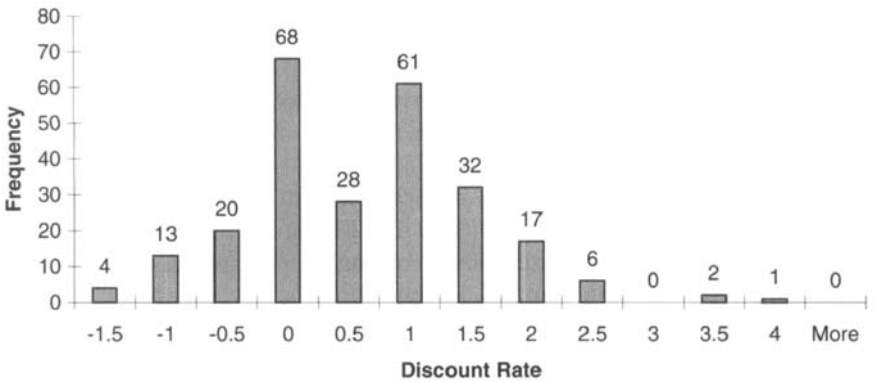
This finding suggests much of the deterrence produced by legal sanctions occurs from their tendency to produce greater extralegal consequences.[11] We find some support for this view from a regression of the value placed on avoiding the extralegal consequences on the severity level, controlling for weekly income. The coefficient for severity is positive and marginally significant ($p < .1$). This suggests that the severity of extralegal consequences may depend on the severity of the legal sanction imposed.

We next examine the "discounting" hypothesis, under which greater present-orientation is expected to diminish the deterrent impact of legal sanctions. Figure 1 presents a histogram of the sample-wide distribution of discount rates. We note first the immense variation in subjects' responses, which range from −175% to +364%. Recall that the discount rate represents the economic embodiment of present-orientation, with higher discount rates reflecting a greater propensity to reduce the weight-afforded delayed consequences. To illustrate how these results apply to

11. Williams and Hawkins (1986) term this type of deterrence "stigma from arrest."

criminal sanctions, consider two individuals, one with a discount rate of 0% and the other whose discount rate is 100%. The zero discount rate implies consequences receive equal weight for decision making regardless of when they are expected to occur. For this individual, the six-month suspension beginning immediately provides the same deterrent impact as a six-month license suspension beginning 1, 2, or 3 years from now. Contrast this weighting with an individual whose discount rate is 100%. For this individual, an immediate 6-month sanction is as aversive as a 12-month sanction one year from now and a 24-month sanction beginning two years from now.

Figure 1 Frequency Distribution of Discount Rates



The distribution of discount rates in Figure 1 provides another notable finding. A celerity effect assumes people prefer to delay adverse outcomes, a preference that should be reflected by a positive discount rate, yet a substantial proportion of subjects, 21%, reported a negative discount rate. For these individuals, a six-month suspension beginning immediately corresponded to a suspension of less than six months in the future, which suggests these subjects would prefer to endure the punishment as soon as possible. The presence of such "negative discounters" challenges a key assumption on which the existence of a celerity effect rests. This unexpected variation in subjects' preferences for the timing of penalties provides further opportunity to probe the role of present-orientation. For whatever reason, negative discounters prefer to endure adverse outcomes immediately. In this sense, they are just the opposite of the high-risk,

Table 3. Tobit Regressions Testing Discounting Effects: Dependent Variable is LIKELIHOOD OF OFFENDING (standard errors in parentheses)

	Enhanced Baseline	Model 2	Model 3	Model 4	Model 5
SEVERITY	−.88	−.95*	−.95*	−1.09*	−.56
	(.47)	(.47)	(.47)	(.52)	(.53)
CERTAINTY	−.51**	−.50**	−.51**	−.50**	−.51**
	(.09)	(.09)	(.09)	(.09)	(.09)
CELERITY	.52	.51	.53	.51	.51
	(.48)	(.48)	(.48)	(.48)	(.47)
ACCIDENT	1.25	1.32	.44	1.31	−.25
(Yes = 1; 0 otherwise)	(4.57)	(4.60)	(4.57)	(4.59)	(4.56)
GENDER	2.84	5.26	5.40	4.80	4.42
(Male = 1; 0 otherwise)	(4.98)	(4.85)	(4.81)	(4.90)	(4.82)
DRUNK-DRIVING	1.43**	1.30**	1.32**	1.30**	1.33**
FREQUENCY: # Times	(.27)	(.27)	(.26)	(.27)	(.26)
Previously Driven Over					
Legal Limit					
WEEKLY INCOME	.007	.0003	.001	.000	−.001
	(.015)	(.0144)	(.014)	(.014)	(.014)
EXTRALEGAL COST:	−.001**	−.001**	−.001**	−.001**	−.001**
Dollar Value Placed on	(.0004)	(.0004)	(.0004)	(.0004)	(.0004)
Avoiding Extralegal					
Sanction					
DISCOUNT RATE:		4.02		1.35	
Average of Subject's Three		(2.58)		(5.09)	
Annual Discounting					
Measures					
NEGATIVE DIS-			−14.4**		−.47
COUNTER: (1 if negative			(5.62)		(10.69)
discount rate, 0 otherwise)					
Interaction:				.30	
SEVERITY*DISCOUNT				(.50)	
RATE					
Interaction:					−1.64
SEVERITY*NEGATIVE					(1.08)
DISCOUNTER					

NOTES: 1—For all regressions, $N = 251$; sample excludes 1 outlying observation.
2—Constant included in all models.
* $p < .05$ for H_0: $\beta = 0$; ** $p < .1$ for H_0: $\beta = 0$.

"present-oriented" group that figures so prominently in theories of persistent individual differences—negative discounters are immensely "future-oriented."[12]

Table 3 reports five regressions exploring the role of present-orientation, as operationalized by the discount rate. The first column of Table 3 contains what we term an enhanced baseline model, which is identical to the baseline model in Table 2, except for the inclusion of the extralegal conviction cost variable. Models 2 and 3 test for main effects of discounting. In the former, we add the discount rate to the enhanced baseline model. In the latter, we replace the discount rate with an indicator variable equal to 1 for negative discounters. Although the discounting variable in model 2 falls short of statistical significance at conventional levels ($p < .12$), its positive sign comports precisely with the Gottfredson/Hirschi and Wilson/Herrnstein views of present-orientation.

The indicator variable for negative discounting in model 3, however, is significantly related to drunk-driving probability. As predicted, negative discounters report lower probabilities of driving while drunk. This negative discounting effect is also large—*ceteris paribus*, negative discounters are 9.8% points less likely to drive while drunk, a 22% reduction from the sample average of 34%.

Models 4 and 5 duplicate models 2 and 3, except for the inclusion of an interaction between the discounting variable and sanction severity. If greater present orientation reduces the severity effect, the interaction of severity with the discount rate should be positive—that is, the higher the discount rate, the less negative is the relationship between sanction severity and offending. We find some support for this prediction in model 4, in which we obtain a positive interaction coefficient. The effect is not, however, statistically significant.

Model 5 is also suggestive. This model includes an interaction of the negative discounter variable and sanction severity. According to our theory, greater present-orientation reduces the influence of sanction severity; thus, we expect a negative coefficient for the interaction. For negative discounters, severity should be a greater deterrent than for positive discounters. We obtain precisely this result with a negative coefficient for the interaction variable ($\beta = -1.64$), but again this interaction falls short of statistical significance ($p < .13$). Still, the point estimate suggests a large impact. When considered in tandem with the main effect severity coefficient in model 5, –.56, the severity effect for negative discounters is nearly four times as large ((–1.64–.56)/.56) as for positive discounters.

We next test the robustness of our findings to the assumption in our

12. Loewenstein (1987) offers an insightful discussion of the broader implications of negative discounting.

model that extralegal sanction costs are triggered primarily by the imposition of a legal sanction. Our survey instrument included a method for identifying individuals whose opposition to the contemplated act appeared independent of potential contact with the criminal justice system. Following the question eliciting respondents' offending likelihood under the penalty conditions in the scenario, respondents were asked to report their offending likelihood if there was no possibility of punishment. For the approximate 15% of subjects answering "0" to both questions, we inferred that the act posed by the scenario afforded no inherent benefits.[13]

Each of the five models in Table 3 was reestimated after excluding the above-described subjects from the sample. All results were essentially unchanged, except for a shift in the relative magnitude of certainty and severity effects. For instance, for the enhanced baseline model estimated on the full sample, an absolute increase in the probability of apprehension of 10% is predicted to reduce the offending probability by 3.5%, whereas the counterpart impact based on the sample without the committed nonoffenders is 2.7%. This occurred because the excluded subjects estimated a substantially greater probability of punishment (66%) than did the balance of the sample (43%). By definition, such subjects also reported an offending likelihood of "0". Reducing the sample in this fashion therefore purged subjects with both high certainty estimates and low offending likelihoods, precisely the group contributing most to the magnitude of an estimated certainty effect. Because the magnitude of the severity effect was unchanged, by implication, the certainty effect was smaller relative to the severity effect when committed nonoffenders were removed. Beyond this one difference, our results were robust to the exclusion of such independently constrained subjects.

Our final prediction concerns the comparative deterrent effect of certainty and severity effects. Although we found significant main effects for each of these variables, their interaction does not significantly predict offending. Further, with the inclusion of a certainty-severity interaction in the enhanced baseline model, the severity effect is eliminated ($p < .6$), and the certainty coefficient remains statistically significant and nearly unchanged. This is one of several findings indicating that the certainty main effect is far more robust than is the severity main effect. The sensitivity of the severity main effect to model specification should not, however, be interpreted to mean that the severity effect is spurious. To the contrary, it is in fact the product of randomized assignment. Instead, we interpret its sensitivity to model specification as reflecting the possibility that the severity impact is largely mediated by extralegal sanction costs and its attendant trigger mechanism, sanction probability. It is in this

13. For such individuals, U(Benefits) = 0.

sense that the results support the prediction that certainty effects will be more pronounced than will be severity effects.

DISCUSSION

We view this as the initial rather than the final step in testing our integrative model of the deterrent effects of the certainty, severity, and celerity of punishment. It would be fruitful to test all aspects of the model with non-college student populations using a similar instrument, but for offenses even more serious than drunk driving. Special emphasis should be given to populations with large numbers of active offenders and individuals at high risk of offending. In this regard, high priority should be given to assembling data from individuals under the control of the juvenile and adult justice systems.

We also believe that broader application of the procedure demonstrated here for monetizing perceptions of legal and extralegal costs has promise for illuminating a number of issues of considerable importance to criminology and public policy. One is the impact of contact with the criminal or juvenile justice system on such perceptions. Much of the extralegal costs arise from the social stigma attendant to being formally sanctioned. However, following an individual's first experience with the criminal justice system, this stigma cost may erode substantially. Testing this hypothesis convincingly requires longitudinal data on legal and extralegal cost perceptions for a population at high risk of contact with the justice system. Assembling such data would be a difficult, but not impossible, task.

Nagin (1998) observed that the stigma cost of sanctions likely depends on the rarity of actual punishment: Just as the stigma of Hester Prynne's scarlet "A" depended on adultery being uncommon in Puritan America, a criminal record cannot be socially and economically isolating if it is commonplace. Thus, policies that are effective in the short term may erode the very basis for their effectiveness over the long run if they increase the proportion of the population who are stigmatized. It would also be valuable to conduct a study of perceived legal and extralegal costs across an ethnically and racially diverse sample to test whether the extralegal cost perceptions of individuals vary systematically with their group's level of contact with the justice system.

As for the celerity effect, further testing is necessary before it can be confidently concluded that the impact of celerity is immaterial. Our study is among only a handful that have tested for celerity effects in a deterrence framework (cf., Howe and Brandau, 1988; Legge and Park, 1994; Yu, 1994), and it is the first to explicitly model the interdependence between celerity and present-orientation.

Because this was an initial foray, we applied the traditional and most

widely held conceptualization of discount rates. In particular, our discount factor produces a function relating the discounted consequence to delay that is exponential and approaches linearity with higher discount rates. Yet application of discounting in other, nonpecuniary domains has uncovered evidence of a "hyperbolic" discount function (Loewenstein and Prelec, 1992). A simple manifestation of hyperbolic discounting is when individuals "choose the larger and later of two alternative cash prizes when both are distant, but change to the smaller, earlier one as they draw nearer" (Ainslie and Haslam, 1992). This anomaly implies consequences may receive a sharp reduction in weight over initial delays, but that such discounting "levels off" as the consequence becomes increasingly temporally remote.

In terms of criminal decision making, hyperbolic discounting implies a pronounced diminution in the impact of sanctions over initial, small delays, with such diminution becoming rapidly less discernible over time. The possibility of hyperbolic discounting may well explain our failure to find a celerity effect. We manipulated punishment delay across three levels: 6, 12, and 18 months. By 6 months, the discounting function for punishment may already flatten out so that delays beyond this point seem relatively insubstantial. More work is needed to test for celerity effects in our integrated framework, with hypothetical delays over more immediate time periods. Such investigation would be especially pertinent to drunk-driving policy because several states are at least considering policies under which driving privileges are suspended immediately when a driver's blood alcohol level is discovered to be over the legal limit. More generally, better specification of a discounting function for punishment will help predict the likely magnitude of celerity effects for various periods of delay.

Finally, individual attitudes toward when the consequences of crime are likely to occur should be distinguished from individual attitudes toward risk. As with impulsivity, attraction to adventure and thrill-seeking is also hypothesized by individual difference theorists to comprise part of an underlying criminal propensity (Gottfredson and Hirschi, 1990). Although impulsivity focuses on the timing of consequences, risk attitudes implicate their likelihood.

In decision making parlance, the criminal opportunity presents a choice between a sure thing (restraint from the criminal act), and a gamble that arises because the contemplated conduct can produce a gain with some probability and a loss with complementary probability. Individuals who tend more toward the safety of a sure thing rather than risk a loss are considered risk-averse. In contrast, individuals with the opposite propensity, namely, to risk a loss for even the slightest chance of reward, are considered risk-seeking. At least several studies have found an association

between this risk-seeking propensity and criminal behavior (Block and Gerety, 1995; Buck, 1989).

As risk preference and time preference embody disparate decision making concepts, a useful next step would explore how much of our discounting effects are attributable to the preference for risk. In this spirit, the next phase of model testing should incorporate appropriate risk preference controls. Such efforts would only propel us further down what we believe is the valuable path of integrating core decision making concepts into one deterrence model to generate a better informed theory and more sensible policies.

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Appendix 1. Means and Standard Deviations for Study Variables

	Mean	Standard Deviation
SEVERITY	8.83	4.96
CERTAINTY	46.54	27.27
CELERITY	12.05	4.80
ACCIDENT (Yes = 1; 0 otherwise)	.55	.50
GENDER (Male = 1; 0 otherwise)	.54	.50
DRUNK-DRIVING FREQUENCY: # Times Previously Driven Over Legal Limit	7.54	9.03
WEEKLY INCOME	270.31	161.76
EXTRALEGAL COST: Dollar Value Placed on Avoiding Extralegal Sanction	4343.36	10,121.20
LEGAL COST: Dollar Value Placed on Avoiding Legal Sanction	2307.12	5471.68
DISCOUNT RATE: Average of Subject's Three Annual Discounting Measures	.42	.89
NEGATIVE DISCOUNTER: (1 if negative discount rate, 0 otherwise)	.25	.44

Appendix 2. Zero-Order Correlations among Study Variables

	SEVERITY	CERTAINTY	CELERITY	ACCIDENT	GENDER
SEVERITY	1.0				
CERTAINTY	−.08	1.0			
CELERITY	−.10	.08	1.0		
ACCIDENT	−.06	−.02	.02	1.0	
GENDER	−.07	−.19	.01	.08	1.0
DRUNK-DRIVING FREQUENCY	−.03	−.30	.06	.11	.28
WEEKLY INCOME	.09	−.15	−.03	−.05	.02
EXTRALEGAL COST	.01	−.13	.09	.06	.05
LEGAL COST	.17	−.03	.07	−.13	.03
DISCOUNT RATE	.04	−.01	.02	−.03	.01
NEGATIVE DISCOUNTER	−.04	.01	.01	−.01	−.01

	DRUNK-DRIVING FREQ.	WEEKLY INCOME	EXTRALEGAL COST	LEGAL COST	DISC. RATE
DRUNK-DRIVING FREQUENCY	1.0				
WEEKLY INCOME	.07	1.0			
EXTRALEGAL COST	.09	.18	1.0		
LEGAL COST	−.02	.09	.53	1.0	
DISCOUNT RATE	.02	−.12	.13	.08	1.0
NEGATIVE DISCOUNTER	−.02	.06	−.06	−.06	−.63